



SEPARATION AND AIRSPACE SAFETY PANEL (SASP)
FOURTH MEETING OF THE WORKING GROUP OF THE
WHOLE
Honolulu, USA, 10 – 21 November 2003

Agenda Item: 4 Separation Minima for ADS-B

DRAFT AMENDMENTS TO PANS ATM DOC 4444 TO INCLUDE PROVISIONS FOR ADS-B
SEPARATION MINIMA AND SERVICES

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SUMMARY

At the last meeting of Project Team 13 of the SASP/WG/WHL, it was agreed that further work should be undertaken in drafting an amendment proposal for Doc 4444 to include procedures for ADS-B services. This paper details two different amendments for the team's consideration that propose to either incorporate ADS-B services in the current Chapter 8 (Radar Services) or provide for a new chapter specifically for ADS-B.

1. INTRODUCTION

1.1 At its last meeting in London, Project Team 13 reviewed an amendment proposal for PANS-ATM Doc 4444, that proposed the inclusion of ADS-B services as a separate stand-alone chapter. This work was to be undertaken in parallel to the team's work in developing a safety assessment for use of ADS-B. Some discussion has taken place during and following the London meeting which suggested that the proposal should be included in the current Chapter 8 of doc 4444 but in so doing keep the current radar provisions and the new ADS-B provisions separated.

2. DISCUSSION

2.1 The team members are reminded that at the last meeting in London there was significant discussion on the best way to draft provisions for ADS-B in Doc 4444. There were some strong views put by one member that the two types of services should be kept separate otherwise there was a chance that the long standing provisions and procedures used for radar would be lost. Other members did not support this view suggesting that there was an opportunity to create a new combined Radar/ADS-B "Surveillance Services" chapter that eliminate duplication of procedures. Another member suggested that the amendment should be framed in such a way that it was generic in detail and that a service provider was only required to meet the surveillance accuracy or other system requirements in order to apply either radar or ADS-B services.

2.2 In attempting to resolve these issues, the team reviewed a proposal from Australia that detailed a new chapter specifically covering ADS-B. In addition, the team drafted a second option amendment, that proposed including ADS-B procedures and requirements in the current radar chapter while clearly preserving the established radar services separately. The team reaffirmed that the proposal should attempt to incorporate radar and ADS-B services into a single chapter, however members still considered there was opportunity to combine specific paragraphs for example 8.1 and 8.2.

2.3 It is suggested that there still seems to be some uncertainty among the team members as to the best option for the draft amendment. To that end this paper has detailed at Appendix 1 and 2, the two options proposed at the London meeting with some amendments, and including changes made as a result of comments received from members since May 2003. Members are reminded that the proposed amendment options are complex changes that will require further detailed work and circulation prior to be finalised. As such, the meeting is encouraged to finalise its decision on the best option for the proposal at this current meeting so that work can be completed in a timely manner.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

1. review the amendment proposals presented in this paper;
2. discuss and decide on the best option for incorporating ADS-B material in Doc 4444 ATM/501; and
3. provide input to the development of the selected draft amendment proposal

CHAPTER 9. AUTOMATIC DEPENDANT SURVEILLANCE BROADCAST (ADS-B) SERVICES

9.1 ADS B HIGH UPDATE RATE SURVEILLANCE SYSTEM : SYSTEMS CAPABILITIES

9.1.1 ADS B used in the provision of air traffic services must have a very high level of reliability, availability and integrity. The possibility of system failures or significant system degradations which may cause complete or partial interruptions of service must be very remote. Back-up facilities must be provided.

Note 1.— A ADS B ground system will normally consist of a number of integrated elements, including sensor(s), data transmission lines, data processing system, air situation displays.

Note 2.— Guidance material and information pertaining to use of ADS B and to system reliability and availability will be contained in Annex 10, Volume I and the Air Traffic Services Planning Manual (Doc 9426).

9.1.2 Multi-sensor systems, i.e. systems utilizing more than one sensor, should have the capability to receive, process and display, in an integrated manner, data from all the connected sensors.

9.1.3 ADS B should be capable of integration with other automated systems used in the provision of ATS, and should provide for an appropriate level of automation with the objectives of improving the accuracy and timeliness of data displayed to the controller and reducing controller workload and the need for verbal coordination between adjacent control positions and ATC units.

9.1.4 ADS B systems should provide for the display of safety-related alerts and warnings, including conflict alert, minimum safe altitude warning, and conflict prediction.

9.1.5 States should, to the extent possible, facilitate the sharing of ADS B information in order to extend and improve ADS B coverage in adjacent control areas.

9.1.6 States should, on the basis of regional air navigation agreements, provide for the automated exchange of coordination data relevant to aircraft being provided with ADS B services, and establish automated coordination procedures.

9.1.7 ADS B systems, may be used alone to provide separation between aircraft, provided:

a) the carriage of ADS B is mandatory within the area; and

b) aircraft identification is established and maintained by use of a **unique 24-bit address code** ~~assigned discrete ADS-B identifiers~~.

9.1.8 The use of ADS B in air traffic services must be limited to specified areas of ADS B coverage and must be subject to such other limitations as have been specified by the appropriate ATS authority. Adequate information on the operating methods used must be published in aeronautical information publications, as well as operating practices and/or equipment limitations having direct effects on the operation of the air traffic services.

Note.— States will provide information on the area or areas where ADS B are in use as well as ADS B services and procedures in accordance with Annex 15, 4.1.1 and Appendix 1.

9.1.9 ADS B may be used either alone or in combination in the provision of air traffic services, including in the provision of separation between aircraft, provided:

- a) reliable coverage exists in the area; and
- b) the probability of detection, the accuracy and the integrity of the ADS B system(s) are satisfactory.

9.2 PRESENTATION OF ADS B INFORMATION

9.2.1 ADS B information available for display to the controller must, as a minimum, include ADS B position indications, and map information.

9.2.2 The ADS B system must provide for a continuously updated presentation of ADS B -derived information, including ADS B position indications.

9.2.3 ADS B position indications may be displayed as distinct ADS B position symbols (ADS B PS).

9.2.4 When applicable, distinct symbols should be used for presentation of:

- a) predicted positions for a non-updated track; and
- b) plot and track data.

9.2.5 ADS B labels should be used to provide, in alphanumeric form, other information which may be available in the down-linked message set.

9.2.6 ADS B label information must as a minimum include the ADS B position, level information and identification of an aircraft. All label information must be presented in a clear and concise manner.

9.2.7 ADS B labels must be associated with their ADS B position indications in a manner precluding erroneous identification by or confusion on the part of the controller

9.3 COMMUNICATIONS

9.3.1 The level of reliability and availability of communications systems must be such that the possibility of system failures or significant degradations is very remote. Adequate backup facilities must be provided.

Note.— Guidance material and information pertaining to system reliability and availability are contained in Annex 10, Volume I and the Air Traffic Services Planning Manual (Doc 9426).

9.3.2 Direct pilot-controller communications must be established prior to the provision of ADS B services, unless special circumstances such as emergencies dictate otherwise.

9.4 PROVISION OF ADS B SERVICES

9.4.1 Where suitable ADS B systems and communication systems are available, ADS B-derived information, including safety-related alerts and warnings such as conflict alert and minimum safe altitude warning, should be used to the extent possible in the provision of air traffic control service in order to improve capacity and efficiency as well as to enhance safety.

9.4.2 The number of aircraft simultaneously provided with ADS B services must not exceed that which can safely be handled under the prevailing circumstances, taking into account:

- a) the structural complexity of the control area or sector concerned;
- b) the ADS B functions to be performed within the control area or sector concerned;
- c) assessments of controller workloads and sector capacity;
- d) the degree of technical reliability and availability of the main ADS B and communication systems;
- e) the possibility of an ADS B equipment failure or other emergency that would eventually require reverting to back-up facilities and/or non-ADS B separation; and
- f) the degree of technical reliability and availability of the back-up ADS B and communication systems

9.5 FUNCTIONS OF HIGH UPDATE RATE SYSTEM [ADS B | DERIVED DATA

9.5.1 The **ADS-B** information presented on an ~~air~~ **ATC** situational display should be used to perform the following functions in the provision of air traffic services:

- a. to provide surveillance services as necessary to improve airspace utilisation, reduce delays, provide for direct routings and more optimum flight profiles, and enhance safety;
- b. to provide vectoring to departing aircraft to facilitate an expeditious and efficient departure flow and expediting climb to cruising level;
- c. to provide vectoring to aircraft to resolve potential conflicts;
- d. to provide vectoring to arriving aircraft to establish an expeditious and efficient approach sequence;
- e. to provide vectoring to assist pilots in their navigation;
- f. to provide separation and maintain normal traffic flow when an aircraft experiences communication failure within surveillance coverage;
- g. to maintain surveillance monitoring of air traffic; and/or
- h. to maintain a watch on the progress of air traffic in order to provide a non-surveillance controller with:
 - i. improved position information regarding aircraft under control;
 - ii. supplementary information regarding other traffic; and
 - iii. information regarding any significant deviations, by aircraft from the terms of their respective clearances

Note: ADS-B will not be used for separation when GNSS is predicted as being unavailable.

9.5.2 Level Information Based On The Use Of ADS B

9.5.2.1 VERIFICATION OF ACCURACY OF ADS B -DERIVED LEVEL INFORMATION

9.5.2.1.1 The tolerance value used to determine that ADS B-derived level information displayed to the controller is accurate must be +/- 90 m (+/- 300 ft). ADS B Geometric Height information must not be used for separation.

9.5.2.1.2 Verification of the accuracy of ADS B-derived level information displayed to the controller must be effected at least once by each suitably equipped ATC unit on initial contact with the aircraft concerned or, if this

is not feasible, as soon as possible thereafter. The verification must be effected by simultaneous comparison with altimeter derived level information received from the same aircraft by radiotelephony. The pilot of the aircraft whose ADS B-derived level information is within the approved tolerance value need not be advised of such verification. Unverified ADS B Geometric Height information must not be used to determine if altitude differences exist.

9.5.2.1.3 If the displayed level information is not within the approved tolerance value or when a discrepancy in excess of the approved tolerance value is detected subsequent to verification, the pilot must be advised accordingly and requested to check the pressure setting and confirm the aircraft's level.

9.5.2.1.4 If, following confirmation of the correct pressure setting the discrepancy continues to exist, the following action should be taken according to circumstances:

a) inform the pilot of the discrepancy and request that ADS B operation continue in order to prevent loss of position and identity information on the aircraft and notify the next control position or ATC unit concerned with the aircraft of the action taken.

9.5.2.2 DETERMINATION OF LEVEL OCCUPANCY

9.5.2.2.1 The criterion which must be used to determine that a specific level is occupied by an aircraft must be ± 90 m (± 300 ft)), except that appropriate ATS authorities may specify a smaller criterion but not less than ± 60 m (± 200 ft) if this is found to be more practical.

Note.— For a brief explanation of the considerations underlying this value see the Air Traffic Services Planning Manual (Doc 9426).

9.5.2.2.2 *Aircraft maintaining a level.* An aircraft is considered to be maintaining its assigned level as long as the ADS B-derived level information indicates that it is within ± 90 m (± 300 ft) of the assigned level.

9.5.2.2.3 *Aircraft vacating a level.* An aircraft cleared to leave a level is considered to have commenced its manoeuvre and vacated the previously occupied level when the ADS B-derived level information indicates a change of more than 90 m (300 ft) in the anticipated direction from its previously assigned level.

9.5.2.2.4 *Aircraft passing a level in climb or descent.* An aircraft in climb or descent is considered to have crossed a level when the ADS B-derived level information indicates that it has passed this level in the required direction by more than 90 m (300 ft).

9.5.2.2.5 *Aircraft reaching a level.* An aircraft is considered to have reached the level to which it has been cleared when three consecutive renewals of ADS B-derived level information have indicated that it is within 90 m (300 ft) of its assigned level.

Note.— In automated ATS systems, the cycles of renewals of ADS B data may not be evident to controllers. It may, therefore, be necessary to specify in instructions to controllers the number of display repetition cycles, or a time interval, corresponding to three consecutive renewals of ADS B data.

9.5.2.2.6 Intervention by a controller must only be required if differences in level information between that displayed to the controller and that used for control purposes are in excess of the values stated above.

9.6 GENERAL ADS B PROCEDURES

9.6.1 Performance checks

9.6.1.1 The controller must be satisfied that the available functional capabilities of the ADS B system as well as the information presented on the air situation display(s) is adequate for the functions to be performed.

9.6.1.2 The controller must report, in accordance with local procedures, any fault in the equipment, or any incident requiring investigation, or any circumstances which make it difficult or impractical to provide ADS B services.

9.6.2 General surveillance

9.6.2.1 Insofar as the performance of other functions permits, the ADS B controller must:

- a. maintain general surveillance of the area of responsibility;
- b. advise the pilot of an identified aircraft when the aircraft concerned is observed to deviate significantly from a route or holding pattern authorised by its air traffic clearance, or is observed to make an incorrect position report; and
- c. initiate incident reporting procedures in respect of any aircraft which is believed to be operating within controlled or restricted airspace without authorisation.

9.6.2.3 Deviations from tracks and holding patterns are not considered significant until the appropriate procedural navigation tolerance is exceeded, or unless an aircraft is observed to be at a position and on a heading which in the controller's opinion would result in the aircraft deviating from such airspace.

9.6.3 Identification Of Aircraft

9.6.3.1 Establishment Of ADS B Identification

9.6.3.1.1 Before providing an ADS B service to an aircraft, identification must be established. Thereafter, identification must be maintained until termination of the ADS B service.

9.6.3.1.2 If ADS B identification is subsequently lost, the pilot must be informed accordingly and, when applicable, appropriate instructions issued.

9.6.3.1.3 ADS B identification must be established by at least one of the following methods.

9.6.4 ADS B Identification Procedures

9.6.4.1 ADS B identification may be established by at least one of the following methods:

Note 1.— The term “a point” refers to a geographical point suitable for the purposes of ADS B identification. It is normally a reporting point defined by reference to a radio navigation aid or other navigation aids.

Note 2 - An RNAV GPS position shall not be used to identify an ADS-B based track. Controllers should request a DME distance or other approved position information where required

- a) direct recognition of the aircraft identification in an ADS-B label;
- b) by transfer of ADS B identification (see Transfer of Identification);
- c) by correlating an observed ADS B position indication with an aircraft which is known to have just departed, provided that the identification is established within 2 km (1 NM) from the end of the runway used. Particular care should be taken to avoid confusion with aircraft holding over or overflying the aerodrome, or with aircraft departing from or making a missed approach over adjacent runways;
- d) observation of compliance with an instruction to squawk ident;

9.6.4.2 When two or more ADS B position indications are observed in close proximity, or are observed to be making similar movements at the same time, or when doubt exists as to the identity of a ADS B position indication for any other reason, changes of heading should be prescribed or repeated as many times as necessary, or additional methods of identification should be employed, until all risk of error in identification is eliminated.

9.6.5 Transfer of ADS B identification

9.6.5.1 Transfer of ADS B identification from one ADS B controller to another should only be attempted when it is considered that the aircraft is within the accepting controller's ADS B coverage.

9.6.5.2 Transfer of ADS B identification must be effected by one of the following methods:

- a) designation of the ADS B position indication by automated means, provided that only one ADS B position indication is thereby indicated and there is no possible doubt of correct identification;
- b) direct designation (pointing with the finger) of the ADS B position indication, if the two ADS-B ATC situation displays are adjacent, or if a common "conference" type of ADS B display is used;

Note.— Attention must be given to any errors which might occur due to parallax effects.

- c) designation of the ADS B position indication by reference to, or in terms of bearing and distance from, a geographical position or navigational facility accurately indicated on both ADS B displays, together with the track of the observed ADS B position indication if the route of the aircraft is not known to both controllers.

Note.— Caution must be exercised before establishing ADS B identification using this method, particularly if other ADS B position indications are observed on similar headings and in close proximity to the aircraft under ADS B control. The appropriate ATS authority may, therefore, prescribe additional conditions for the application of this method, e.g.: i) a maximum distance from the common reference point used by the two controllers; and ii) a maximum distance between the ADS B position indication as observed by the accepting controller and the one stated by the transferring controller.

9.6.6 Position information

9.6.6.1 An aircraft provided with ADS B service should be informed of its position in the following circumstances:

- a) upon identification, except when the identification is established:
 - i) based on the pilot's report of the aircraft position or within one nautical mile of the runway upon departure and the observation is consistent with the aircraft's time of departure; or
 - ii) by use of direct recognition of the aircraft identification in an ADS-B label and the location of the observed position indication is consistent with the current flight plan of the aircraft;
 - iii) by transfer of ADS B position identification;
- b) when the pilot requests this information;
- c) when a pilot's estimate differs significantly from the ADS B controller's estimate based on ADS B observation;

- d) when the pilot is instructed to resume own navigation after ADS B vectoring if the current instructions had diverted the aircraft from a previously assigned route, (see 9.6.7.5);
- e) immediately before termination of ADS B service, if the aircraft is observed to deviate from its intended route.

9.6.6.2 Position information must be passed to aircraft in one of the following forms:

- a) as a well-known geographical position;
- b) magnetic track and distance to a significant point, an en-route navigation aid, or an approach aid;
- c) direction (using points of the compass) and distance from a known position;
- d) distance to touchdown, if the aircraft is on final approach; or
- e) distance and direction from the centre line of an ATS route.

9.6.6.3 Whenever practicable, position information must relate to positions or routes pertinent to the navigation of the aircraft concerned and displayed on the ATC Situation Display.

9.6.6.4 When so informed, the pilot may omit position reports at compulsory reporting points or report only over those reporting points specified by the air traffic services unit concerned, including points at which air-reports are required for meteorological purposes. Pilots must resume position reporting when so instructed and when advised that ADS-B service is terminated or that ADS-B identification is lost.

9.6.7 ADS B vectoring

9.6.7.1 ADS B vectoring must be achieved by issuing to the pilot specific headings which will enable the aircraft to maintain the desired track. When vectoring an aircraft, a ~~ADS-B~~ controller should comply with the following:

- a) whenever practicable, the aircraft should be vectored along routes or tracks on which the pilot can monitor the aircraft position with reference to pilot-interpreted ground-based navigation aids (this will minimize the amount of ADS B navigational assistance required and alleviate the consequences resulting from a ADS B failure);
- b) when an aircraft is given a vector diverting it from a previously assigned route, the pilot should be informed, unless it is self-evident, what the vector is to accomplish and, when possible, the limit of the vector should be specified (e.g. to ... position, for ... approach);
- c) except when transfer of ADS B control is to be effected, aircraft must not be vectored closer than 4.6 km (2.5 NM), or, where a ADS B separation minimum greater than 9.3 km (5 NM) is prescribed, a distance equivalent to one half of the prescribed separation minimum, from the limit of the airspace for which the ADS B controller is responsible, unless local arrangements have been made to ensure that separation will exist with ADS B or radar -controlled aircraft operating in adjoining areas;
- d) controlled flights should not be vectored into uncontrolled airspace except in the case of emergency or in order to circumnavigate severe weather (in which case the pilot should be so informed), or at the specific request of the pilot; and
- e) when an aircraft has reported unreliable directional instruments, the pilot should be requested, prior to the issuance of manoeuvring instructions, to make all turns at an agreed rate and to carry out the instructions immediately upon receipt.

9.6.7.2 When vectoring an IFR flight, the ADS B controller must issue clearances such that the prescribed obstacle clearance will exist at all times until the aircraft reaches the point where the pilot will resume own navigation. When necessary, the minimum ADS B vectoring altitude must include a correction for low temperature effect.

Note 1.— When an IFR flight is being vectored, the pilot is often unable to determine the aircraft's exact position and consequently the altitude which provides the required obstacle clearance. Detailed obstacle clearance criteria are contained in PANS-OPS (Doc 8168), Volume I, Part VI, Chapter 3 (Altimeter Corrections) and Volume II, Part II, Departure Procedures, Part III, 24.2.2.3 (Procedures based on tactical vectoring), and Part VI (Obstacle Clearance Criteria for Enroute).

Note 2.— It is the responsibility of the ATS authority to provide the controller with minimum altitudes corrected for temperature effect.

9.6.7.3 Whenever possible, minimum vectoring altitudes should be sufficiently high to minimize activation of aircraft ground proximity warning systems.

Note.— Activation of such systems will induce aircraft to pull up immediately and climb steeply to avoid hazardous terrain, possibly compromising separation between aircraft.

9.6.7.4 States must encourage operators to report incidents involving activations of aircraft ground proximity warning systems so that their locations can be identified and altitude, routing and/or aircraft operating procedures can be altered to prevent recurrences.

9.6.7.5 In terminating ADS B vectoring of an aircraft, the ADS B controller must instruct the pilot to resume own navigation, giving the pilot the aircraft's position and appropriate instructions, as necessary, in the form prescribed previously, if the current instructions had diverted the aircraft from the previously assigned route.

9.6.8 Navigation Assistance

9.6.8.1 An identified aircraft observed to deviate significantly from its intended route or designated holding pattern must be advised accordingly. Appropriate action must also be taken if, in the opinion of the controller, such deviation is likely to affect the service being provided.

9.6.8.2 The pilot of an aircraft requesting navigation assistance from an air traffic control unit providing ADS B services must state the reason (e.g. to avoid areas of adverse weather or unreliable navigational instruments) and must give as much information as possible in the circumstances.

9.6.9 Interruption or termination of ADS B service

9.6.9.1 An aircraft which has been informed that it is provided with ADS B service should be informed immediately when, for any reason, ADS B service is interrupted or terminated unless a surveillance service of the same standard is being utilised.

9.6.9.2 When the control of an aircraft is to be transferred from an ADS B controller to a ~~non-ADS B~~ controller ~~not providing surveillance services~~, the ADS B controller must ensure that non-ADS B separation is established between that aircraft and any other controlled aircraft before the transfer is effected.

9.6.10 Minimum levels

9.6.10.1 An ADS B controller must at all times be in possession of full and up-to-date information regarding:

a) established minimum flight altitudes within the area of responsibility;

- b) the lowest usable flight level or levels determined in accordance with Chapters 4 and 5; and
- c) established minimum altitudes applicable to procedures based on tactical ADS B vectoring.

Note.— Criteria for the determination of minimum altitudes applicable to procedures based on tactical radar vectoring are contained in Procedures for Air Navigation Services — Aircraft Operations (PANS-OPS, Doc 8168), Volume II, Part III.

9.6.11 Information Regarding Adverse Weather

9.6.11.1 Information that an aircraft appears likely to penetrate an area of adverse weather should be issued in sufficient time to permit the pilot to decide on an appropriate course of action, including that of requesting advice on how best to circumnavigate the adverse weather area, if so desired.

Note.— Depending on the capabilities of the ATC situation display system, areas of adverse weather may not be presented on the radar display. An aircraft's weather radar will normally provide better detection and definition of adverse weather than radar sensors in use by ATS.

9.6.11.2 In vectoring an aircraft for circumnavigating any area of adverse weather, the ADS B controller should ascertain that the aircraft can be returned to its intended or assigned flight path within the available ADS B coverage, and, if this does not appear possible, inform the pilot of the circumstances.

Note.— Attention must be given to the fact that under certain circumstances the most active area of adverse weather may not show on a ADS-B controllers display.

9.7 USE OF ADS B HIGH UPDATE SYSTEMS IN THE PROVISION OF AN AIR TRAFFIC CONTROL SERVICE

Note.— The procedures in this Section are general procedures applicable when ADS-B is used in the provision of area control service or approach control service. Additional procedures applicable in the provision of approach control service are detailed in Section 8.9.

9.7.1 ADS B Functions

9.7.1.1 The ADS-B information presented on a ATC situation ADS-B display may be used to perform the following functions in the provision of air traffic control service:

- a) provide ADS-B services as necessary in order to improve airspace utilization, reduce delays, provide for direct routings and more optimum flight profiles, as well as to enhance safety;
- b) provide ADS-B vectoring:
 - i) to departing aircraft for the purpose of facilitating an expeditious and efficient departure flow and expediting climb to cruising level;
 - ii) to aircraft for the purpose of resolving potential conflicts;
 - iii) to arriving aircraft for the purpose of establishing an expeditious and efficient approach sequence;
 - iv) to assist pilots in their navigation, e.g. to or from a radio navigation aid, navigation waypoint, or away from or around areas of adverse weather, etc.;

c) provide separation and maintain normal traffic flow when an aircraft experiences communication failure within the area of the ADS B coverage;

d) maintain ADS B monitoring of air traffic;

Note.— Where tolerances regarding such matters as adherence to track, speed or time have been prescribed by the appropriate ATS authority, deviations are not considered significant until such tolerances are exceeded.

e) when applicable, maintain a watch on the progress of air traffic, in order to provide a ~~non-ADS B~~ controller not providing surveillance services with:

i) improved position information regarding aircraft under control;

ii) supplementary information regarding other traffic; and

iii) information regarding any significant deviations by aircraft from the terms of their respective air traffic control clearances, including their cleared routes as well as levels, when appropriate.

9.7.2 Coordination of traffic under ADS B control and traffic not being provided with surveillance services ~~non-ADS B control~~

9.7.2.1 Appropriate arrangements must be made in any air traffic control unit using ADS B to ensure the coordination of traffic under ADS B control with ~~traffic not being provided with surveillance services under non-ADS B control~~, and to ensure the provision of adequate separation between the ADS B -controlled aircraft and all other controlled aircraft. To this end, close liaison must be maintained at all times between ADS B controllers and ~~non-ADS B~~ controllers not providing surveillance services.

9.7.3 Separation Application

Note.— Factors which the ADS B controller must take into account in determining the spacing to be applied in particular circumstances in order to ensure that the separation minimum is not infringed include aircraft relative headings and speeds, ADS B technical limitations, controller workload and any difficulties caused by communication congestion. Guidance material on this subject is contained in the Air Traffic Services Planning Manual (Doc 9426).

9.7.3.1 Except as provided for in 9.7.3.7, 9.7.3.8 and 9.8.3.2, ADS B separation must only be applied between identified aircraft when there is reasonable assurance that identification will be maintained.

9.7.3.2 Except when transfer of ADS B control is to be effected, ~~non-ADS B separation~~ another form of separation must be established by a ADS B controller before an aircraft under ADS B control reaches the limits of the controller's area of responsibility, or before the aircraft leaves the area of ADS B coverage.

9.7.3.3 When authorised by the appropriate ATS authority, ADS B separation based on the use of ADS B position symbols ~~and/or PSR blips~~ must be applied so that the distance between the centres of the ADS B position symbols ~~and/or PSR blips~~, representing the positions of the aircraft concerned, is never less than a prescribed minimum.

9.7.3.4 ADS B separation based on the use of ADS B ~~blips~~ position symbols and SSR ~~or ADS B~~ responses must be applied so that the distance between the ~~edges~~ of the ADS B ~~blip~~ position symbol and the nearest edge of the SSR ~~or ADS B~~ response (or the centre, when authorized by the appropriate ATS authority) is never less than a prescribed minimum.

Comment: Check centres v edges

9.7.3.5 ADS B separation based on the use of ADS B position symbols and PSR blips must be applied so that the distance between the centres of the ADS B position symbols and PSR blips, representing the positions of the aircraft concerned, is never less than a prescribed minimum.

9.7.3.6 In no circumstances must the edges of the ADS B position indications touch or overlap unless vertical separation is applied between the aircraft concerned, irrespective of the type of ADS B position indication displayed and ADS B separation minimum applied.

9.7.3.7 In the event that the ADS B controller has been notified of a controlled flight entering or about to enter the airspace within which ADS B separation is applied, but has not ADS B identified the aircraft, the controller may, if so prescribed by the appropriate ATS authority, continue to provide ADS B service to identified aircraft provided that:

a) reasonable assurance exists that the unidentified controlled flight will be identified using SSR or ADS B or the flight is being operated by an aircraft of a type which may be expected to give an adequate return on primary radar in the airspace within which ADS B separation is applied; and

b) ADS B separation is maintained between the ADS B controlled flights and any other observed ADS B position until either the unidentified controlled flight has been identified or ~~non-ADS B~~ another form of separation has been established.

9.7.3.8 ADS B separation may be applied between an aircraft taking off and a preceding departing aircraft or other ADS B -controlled traffic provided there is reasonable assurance that the departing aircraft will be identified within 2 km (1 NM) from the end of the runway, and that, at the time, the required separation will exist.

9.7.3.9 ADS B separation must not be applied between aircraft holding over the same holding point. Application of ADS B separation between holding aircraft and other flights must be subject to requirements and procedures prescribed by the appropriate ATS authority.

9.7.4 ADS B Separation Minima

9.7.4.1 Unless otherwise prescribed in accordance with 9.7.4.2, 9.7.4.3 or 9.7.4.4, ~~or Chapter 6 with respect to independent and dependent parallel approaches~~, the horizontal ADS B separation minimum must be 9.3 km (5.0 NM).

9.7.4.2 The ADS B separation minimum in 9.7.4.1 may, if so prescribed by the appropriate ATS authority, be reduced, but not below:

a) 5.6 km (3.0 NM) when ADS B capabilities at a given location so permit; and

b) 4.6 km (2.5 NM) between succeeding aircraft which are established on the same final approach track within 18.5 km (10 NM) of the runway end. A reduced separation minimum of 4.6 km (2.5 NM) may be applied, provided:

i) the average runway occupancy time of landing aircraft is proven, by means such as data collection and statistical analysis and methods based on a theoretical model, not to exceed 50 seconds;

ii) braking action is reported as good and runway occupancy times are not adversely affected by runway contaminants such as slush, snow or ice;

iii) a ADS B system with appropriate azimuth and range resolution and an update rate of 5 seconds or less is used in combination with suitable ADS B displays; and

~~iv) the aerodrome controller is able to observe, visually or by means of surface movement radar (SMR) or a surface movement guidance and control system (SMCGS), the runway in use and associated exit and entry taxiways;~~

~~v) wake turbulence ADS B separation minima in 8.9.4.4, or as may be prescribed by the appropriate ATS authority (e.g. for specific aircraft types), do not apply;~~

~~vi) aircraft approach speeds are closely monitored by the controller and when necessary adjusted so as to ensure that separation is not reduced below the minimum;~~

~~vii) aircraft operators and pilots have been made fully aware of the need to exit the runway in an expeditious manner whenever the reduced separation minimum on final approach is applied; and~~

~~viii) procedures concerning the application of the reduced minimum are published in AIPs.~~

9.7.4.3 The ADS B separation minimum or minima to be applied must be prescribed by the appropriate ATS authority according to the capability of the particular ADS B system or sensor to accurately identify the aircraft position in relation to the centre of an ADS B position symbol and taking into account factors which may affect the accuracy of the ADS B -derived information.

9.7.4.4 The following wake turbulence ADS B separation minima must be applied to aircraft in the approach and departure phases of flight in the circumstances given in 9.7.4.4.1.

| Aircraft category | | |
|--------------------|---------------------|---|
| Preceding aircraft | Succeeding aircraft | Wake turbulence ADS B separation minima |
| HEAVY | HEAVY | 7.4 km (4.0 NM) |
| | MEDIUM | 9.3 km (5.0 NM) |
| | LIGHT | 11.1 km (6.0 NM) |
| MEDIUM | LIGHT | 9.3 km (5.0 NM) |

Note.— The provisions governing wake turbulence aircraft categorization are set forth in Chapter 4, Section 4.9.

9.7.4.4.1 The minima set out above must be applied when:

a) an aircraft is operating directly behind another aircraft at the same altitude or less than 300 m (1 000 ft) below;
or

b) both aircraft are using the same runway, or parallel runways separated by less than 760 m; or

c) an aircraft is crossing behind another aircraft, at the same altitude or less than 300 m (1 000 ft) below.

9.7.5 Transfer of ADS B Control

9.7.5.1 Transfer of ADS B control should be effected whenever practicable so as to enable the uninterrupted provision of ADS B service.

9.7.5.2 Where the ADS B system provides for the display of ADS B position indications with associated ADS B labels, transfer of ADS B control of aircraft between adjacent control positions or between adjacent ATC units may be effected without prior coordination, provided that:

- a) updated flight plan information on the aircraft about to be transferred, including the 24 bit address and/or the associated aircraft identification ~~transponder Code~~, is provided to the accepting controller prior to transfer;
- b) ADS B coverage provided to the accepting controller is such that the aircraft concerned is presented on the ~~ADS-B~~ ATC situation display before the transfer is effected and is identified on, but preferably before, receipt of the initial call;
- c) When the controllers are not physically adjacent, two-way direct speech facilities, which permit communications to be established instantaneously, are available between them at all times;

Note.— “Instantaneous” refers to communications which effectively provide for immediate access between controllers.

- d) the transfer point or points and all other conditions of application, such as direction of flight, specified levels, transfer of communication points, and especially an agreed minimum separation between aircraft, including that applicable to succeeding aircraft on the same route, about to be transferred as observed on the display, have been made the subject of specific instructions (for intra-unit transfer) or of a specific letter of agreement between two adjacent ATC units;
- e) the instructions or letter of agreement specify explicitly that the application of this type of transfer of ADS B control may be terminated at any time by the accepting controller, normally with an agreed advance notice;
- f) the accepting controller is kept currently informed of any level, speed or vectoring instructions given to the aircraft prior to its transfer and which modify its anticipated flight progress at the point of transfer.

9.7.5.3 The minimum agreed separation between aircraft about to be transferred and the advance notice must be determined taking into account all relevant technical, operational and other circumstances. If circumstances arise in which these agreed conditions can no longer be satisfied, controllers must revert to the procedure below until the situation is resolved.

9.7.5.4 Where ADS B is being used, but the provisions above are not applied, the transfer of ADS B control of aircraft between adjacent control positions or between two adjacent ATS units may be effected, provided that:

- a) ADS B identification has been transferred to or has been established directly by the accepting ADS B controller;
- b) When the ADS B controllers are not physically adjacent, two-way direct-speech facilities between them are at all times available which permit communications to be established instantaneously;
- c) ADS B separation from other ADS B -controlled flights conforms to the minima authorized for use during transfer of ADS B control between the ADS B sectors or units concerned;
- d) The accepting ADS B-controller is informed of any level, speed or vectoring instructions applicable to the aircraft at the point of transfer;
- e) Radio communication with the aircraft is retained by the transferring ADS B controller until the accepting ADS B controller has agreed to assume responsibility for providing ADS B service to the aircraft. Thereafter, the aircraft should be instructed to change over to the appropriate frequency and from that point is the responsibility of the accepting ADS B controller.

9.7.6 Speed control

9.7.6.1 Subject to conditions specified by the appropriate ATS authority, including consideration of aircraft performance limitations, an ADS B controller may, in order to facilitate ADS B control or to reduce the need for ~~ADS B~~ vectoring, request aircraft under ~~ADS B~~ control to adjust their speed in a specified manner.

Note. — Procedures for speed control instructions are contained in Chapter 4, Section 4.6.

9.8 EMERGENCIES, HAZARDS AND EQUIPMENT FAILURES

Note. — See also Chapter 15.

9.8.1 Emergencies

9.8.1.1 In the event of an aircraft in, or appearing to be in, any form of emergency, every assistance must be provided by the ADS B controller, and the procedures prescribed herein may be varied according to the situation.

9.8.1.2 The progress of an aircraft in emergency must be monitored and (whenever possible) plotted on the ~~ADS B~~ ATC situation display, or otherwise recorded, until the aircraft passes out of ADS B coverage, and position information must be provided to all air traffic services units which may be able to give assistance to the aircraft. ADS B transfer to adjacent ADS B sectors must also be effected when appropriate.

Note. — If the pilot of an aircraft encountering a state of emergency has previously been directed by ATC to operate the ADS B Emergency, that state will normally be maintained unless, the pilot has decided or has been advised otherwise. Where ATC has not requested **an** ADS Emergency to be set, the pilot will set the SSR transponder to Mode A Code 7700.

Comment: Need to review words esp Code 7700

9.8.2 Collision hazard information

9.8.2.1 When an identified controlled flight is observed to be on a conflicting path with an unknown aircraft deemed to constitute a collision hazard, the pilot of the controlled flight must, whenever practicable:

- a) be informed of the unknown aircraft and if so requested by the controlled flight or, if in the opinion of the ADS B controller the situation warrants, a course of avoiding action should be suggested; and
- b) be notified when the conflict no longer exists.

9.8.2.2 When an identified IFR flight operating outside controlled airspace is observed to be on a conflicting path with another aircraft, the pilot should:

- a) be informed as to the need for collision avoidance action to be initiated, and if so requested by the pilot or if, in the opinion of the ADS B controller, the situation warrants, a course of avoiding action should be suggested; and
- b) be notified when the conflict no longer exists.

9.8.2.3 Information regarding traffic on a conflicting path should be given, whenever practicable, in the following form:

- a) relative bearing of the conflicting traffic in terms of the 12-hour clock;
- b) distance from the conflicting traffic in kilometres (nautical miles);
- c) direction in which the conflicting traffic appears to be proceeding;

d) level and type of aircraft or, if unknown, relative speed of the conflicting traffic, e.g. slow or fast.

9.8.2.4 ~~Barometric~~ ~~ADS-B~~ derived level information, even when unverified, should be used in the provision of collision hazard information because such information, particularly if available from an otherwise unknown aircraft (e.g. a VFR flight) and given to the pilot of a known aircraft, could facilitate the location of a collision hazard.

Comment: Confirm derivation terminology

9.8.2.5 When the ~~ADS-B~~ ~~barometric~~ derived level information has been verified, the information must be passed to pilots in a clear and unambiguous manner. If the level information has not been verified, the accuracy of the information should be considered uncertain and the pilot must be informed accordingly.

9.8.3 Failure of Equipment

9.8.3.1 AIRCRAFT RADIO TRANSMITTER FAILURE

9.8.3.1.1 If two-way communication is lost with an aircraft, the ADS B controller should determine whether or not the aircraft's receiver is functioning by instructing the aircraft on the frequency so far used to acknowledge by making a specified manoeuvre and by observing the aircraft's track.

9.8.3.1.2 If the action prescribed above is unsuccessful, it must be repeated on any other available frequency on which it is believed that the aircraft might be listening.

9.8.3.1.3 In both the cases covered by above, any manoeuvring instructions must be such that the aircraft would regain its current cleared track after having complied with the instructions received.

9.8.3.1.4 Where it has been established by the action above that the aircraft's radio receiver is functioning, continued control of ~~transponder-equipped aircraft where SSR is available~~ can be effected using ~~code aircraft identification~~ changes or IDENT transmissions to obtain acknowledgement of clearances issued to the aircraft.

9.8.3.2 COMPLETE AIRCRAFT COMMUNICATION FAILURE

When a controlled aircraft experiencing complete communication failure is operating or expected to operate in an area and at flight levels where ADS B separation is applied, such separation may continue to be used. However, if the aircraft experiencing the communication failure is not identified, ADS B separation must be applied between aircraft under ADS B control and all unidentified aircraft observed along the expected route of the aircraft with the communication failure, until such time as it is known, or can safely be assumed, that the aircraft with radio failure has passed through the airspace concerned, has landed, or has proceeded elsewhere.

Comment: Needs review – ability to assume non ident ads b a/s

9.8.4 ADS B equipment failure

9.8.4.1 In the event of complete failure of the ADS B equipment, except for air-ground communications, the ADS B controller must:

a) plot the positions of all aircraft already identified and, ~~in conjunction with the non-ADS-B controller when applicable~~, take the necessary action to establish ~~non-ADS-B~~ separation between the aircraft; and when relevant:

b) ~~request the appropriate non-ADS-B controller to assume control of the traffic affected;~~

c) ~~instruct aircraft to communicate with the appropriate non-ADS-B controller for further instructions.~~

9.8.4.2 As an emergency measure, use of flight levels spaced by half the applicable vertical separation minimum may be resorted to applied temporarily if ~~until~~ standard ~~non-ADS-B~~ separation cannot be provided immediately.

9.8.4.3 ~~Except when there is assurance that the complete ADS-B equipment failure will be of a very limited duration, steps should be taken to limit the number of aircraft permitted to enter the area to that which can be safely handled without the use of ADS-B.~~

9.8.5 Ground Radio Failure

9.8.5.1 In the event of complete failure of the ground radio equipment used for ADS B control, the ~~ADS-B~~ controller must, unless able to continue to provide the ADS B service by means of other available communication channels, proceed as set forth in 9.8.4.1 a) ~~and b).~~

9.8.5.2 Where the provisions in 9.8.4.1 are not applicable, the controller must:

- a) without delay inform all adjacent control positions or ATC units, as applicable, of the failure;
- b) appraise such positions or units of the current traffic situation;
- c) request their assistance, in respect of aircraft which may establish communications with those positions or units, in establishing ADS B or ~~non-ADS-B~~ other separation between and maintaining control of such aircraft; and
- d) instruct adjacent control positions or ATC units to hold or reroute all controlled flights outside the area of responsibility of the position or ATC unit that has experienced the failure until such time that the provision of normal services can be resumed.

9.8.5.3 In order to reduce the impact of complete ground radio equipment failure on the safety of air traffic, the appropriate ATS authority should establish contingency procedures to be followed by control positions and ATC units in the event of such failures. Where feasible and practicable, such contingency procedures should provide for the delegation of control to an adjacent control position or ATC unit in order to permit a minimum level of services to be provided as soon as possible, following the ground radio failure and until normal operations can be resumed.

9.9 USE OF ADS-B IN THE APPROACH CONTROL SERVICE

9.9.1 General Provisions

9.9.1.1 ~~ADS-B systems used in the provision of approach control service must be appropriate to the functions and level of service to be provided.~~

9.9.1.2 ~~ADS-B systems used to monitor parallel ILS approaches must meet the requirements for such operations specified in Chapter 6.~~

9.9.2 Functions

~~The ADS-B information presented on a ADS-B air situation display may be used to perform the following additional functions in the provision of approach control service:~~

- a) ~~provide ADS-B vectoring of arriving traffic on to pilot interpreted final approach aids;~~

b) ~~provide ADS B monitoring of parallel ILS approaches and instruct aircraft to take appropriate action in the event of possible or actual penetrations of the no transgression zone (NTZ);~~

Note. ~~See Chapter 6, Section 6.7.~~

c) ~~provide ADS B vectoring of arriving traffic to a point from which a visual approach can be completed;~~

d) ~~provide ADS B vectoring of arriving traffic to a point from which a precision ADS B approach or a surveillance ADS B approach can be made;~~

e) ~~provide ADS B monitoring of other pilot interpreted approaches;~~

f) ~~in accordance with prescribed procedures, conduct:~~

i) ~~surveillance ADS B approaches;~~

ii) ~~precision radar (PAR) approaches; and~~

g) ~~provide ADS B separation between:~~

i) ~~succeeding departing aircraft;~~

ii) ~~succeeding arriving aircraft; and~~

iii) ~~a departing aircraft and a succeeding arriving aircraft.~~

9.9.3 General Approach ADS B Procedures

9.9.3.1 The appropriate ATS authority must establish procedures to ensure that the aerodrome controller is kept informed of the sequence of arriving aircraft, as well as any instructions and restrictions which have been issued to such aircraft in order to maintain separation after transfer of control to the aerodrome controller.

9.9.3.2 Prior to, or upon commencement of, ADS B vectoring for approach, the pilot must be advised of the type of approach as well as the runway to be used.

9.9.3.3 The ADS B controller must advise an aircraft being ADS B vectored for an instrument approach of its position at least once prior to commencement of final approach.

9.9.3.4 When giving distance information, the ADS B controller must specify the point or navigation aid to which the information refers.

9.9.3.5 The initial and intermediate approach phases of an approach executed under the direction of a ADS B controller comprise those parts of the approach from the time ADS B vectoring is initiated for the purpose of positioning the aircraft for a final approach, until the aircraft is on final approach and:

a) ~~established on the final approach path of a pilot interpreted aid; or~~

b) ~~reports that it is able to complete a visual approach; or~~

c) ~~ready to commence a surveillance radar approach; or~~

d) ~~transferred to the precision radar approach controller.~~

~~9.9.3.6 Aircraft vectored for final approach should be given a heading or a series of headings calculated to close with the final approach track.~~

~~The final vector must enable the aircraft to be established in level flight on the final approach track prior to intercepting the specified or nominal glide path if an MLS, ILS or radar approach is to be made, and should provide an intercept angle with the final approach track of 45 degrees or less.~~

~~9.9.3.7 Whenever an aircraft is assigned a ADS-B vector which will take it through the final approach track, it should be advised accordingly, stating the reason for the vector.~~

9.9.4 Vectoring To Pilot Interpreted Final Approach Aid

~~9.9.4.1 An aircraft vectored to intercept a pilot interpreted final approach aid must be instructed to report when established on the final approach track.~~

~~9.9.4.2 Clearance for the approach should be issued prior to when the aircraft reports established, unless circumstances preclude the issuance of the clearance at such time. ADS-B vectoring will normally terminate at the time the aircraft leaves the last assigned heading to intercept the final approach track.~~

~~9.9.4.3 The ADS-B controller must be responsible for maintaining ADS-B separation between succeeding aircraft on the same final approach, except that the responsibility may be transferred to the aerodrome controller in accordance with procedures prescribed by the appropriate ATS authority and provided ADS-B information is available to the aerodrome controller.~~

~~9.9.4.4 Transfer of control of succeeding aircraft on final approach from the ADS-B controller to the aerodrome controller must be effected in accordance with procedures prescribed by the appropriate ATS authority.~~

~~9.9.4.5 Transfer of communications to the aerodrome controller should be effected at such a point or time that clearance to land or alternative instructions can be issued to the aircraft in a timely manner.~~

9.9.5 Vectoring For Visual Approach

Note.—See also Chapter 6, Section 6.5.3.

~~9.9.5.1 The ADS-B controller may initiate ADS-B vectoring of an aircraft for visual approach provided the reported ceiling is above the minimum altitude applicable to ADS-B vectoring and meteorological conditions are such that, with reasonable assurance, a visual approach and landing can be completed.~~

~~9.9.5.2 Clearance for visual approach must be issued only after the pilot has reported the aerodrome or the preceding aircraft in sight, at which time ADS-B vectoring would normally be terminated.~~

9.10 USE OF ADS BS IN THE AERODROME CONTROL SERVICE

9.10.1 Surveillance ADS-B

~~9.10.1.1 When authorized by and subject to conditions prescribed by the appropriate ATS authority, surveillance ADS-B may be used in the provision of aerodrome control service to perform the following functions:~~

- ~~a) ADS-B monitoring of aircraft on final approach;~~
- ~~b) ADS-B monitoring of other aircraft in the vicinity of the aerodrome;~~
- ~~c) establishing ADS-B separation between succeeding departing aircraft; and~~
- ~~d) providing navigation assistance to VFR flights.~~

~~9.10.1.2 Special VFR flights must not be ADS-B vectored unless special circumstances, such as emergencies, dictate otherwise.~~

~~9.10.1.3 Caution must be exercised when ADS-B vectoring VFR flights so as to ensure that the aircraft concerned does not inadvertently enter instrument meteorological conditions.~~

~~9.10.1.4 In prescribing conditions and procedures for the use of ADS-B in the provision of aerodrome control service, the appropriate ATS authority must ensure that the availability and use of ADS-B information will not be detrimental to visual observation of aerodrome traffic.~~

~~Note.—Control of aerodrome traffic is in the main based on visual observation of the manoeuvring area and the vicinity of the aerodrome by the aerodrome controller.~~

9.11 USE OF ADS BS IN THE FLIGHT INFORMATION SERVICE

~~Note.—The use of ADS-B in the provision of flight information service does not relieve the pilot-in-command of an aircraft of any responsibilities, including the final decision regarding any suggested alteration of the flight plan.~~

9.11.1 Functions

~~9.11.1.1 The ADS-B information presented on a air situation display may be used to provide identified aircraft with:~~

~~a) information regarding any aircraft observed to be on a conflicting path with the ADS-B identified aircraft and suggestions or advice regarding avoiding action;~~

~~b) information to assist the aircraft in its navigation.~~

~~9.11.1.2 *ADS-B air traffic advisory service.* When ADS-B is used in the provision of air traffic advisory service, the procedures in Section 8.2 for the use of ADS-B in the air traffic control service must be applied subject to the conditions and limitations governing the provision of air traffic advisory service, as set forth in Chapter 9, 9.1.4~~

CHAPTER 8. RADAR and ADS B SURVEILLANCE SERVICES

Note 1 – Surveillance systems are considered to be:

1. Primary Radar [PSR]
2. SSR and MSSR
3. ADS B

8.1 SURVEILLANCE SYSTEM: RADAR SYSTEMS CAPABILITIES

8.1.1 Radar systems used in the provision of air traffic services must have a very high level of reliability, availability and integrity. The possibility of system failures or significant system degradations which may cause complete or partial interruptions of service must be very remote. Back-up facilities must be provided.

Note 1.— A radar system will normally consist of a number of integrated elements, including radar sensor(s), radar data transmission lines, radar data processing system, radar displays.

Note 2.— Guidance material and information pertaining to use of radar and to system reliability and availability is contained in Annex 10, Volume I and the Air Traffic Services Planning Manual (Doc 9426).

8.1.2 Multi-radar systems, i.e. systems utilizing more than one radar sensor, should have the capability to receive, process and display, in an integrated manner, data from all the connected sensors.

8.1.3 Radar systems should be capable of integration with other automated systems used in the provision of ATS, and should provide for an appropriate level of automation with the objectives of improving the accuracy and timeliness of data displayed to the Air Traffic Controller and reducing Air Traffic Controller workload and the need for verbal coordination between adjacent control positions and ATC units.

8.1.4 Radar systems should provide for the display of safety-related alerts and warnings, including conflict alert, minimum safe altitude warning, conflict prediction and unintentionally duplicated SSR codes.

8.1.5 States should, to the extent possible, facilitate the sharing of radar information in order to extend and improve radar coverage in adjacent control areas.

8.1.6 States should, on the basis of regional air navigation agreements, provide for the automated exchange of coordination data relevant to aircraft being provided with radar services, and establish automated coordination procedures.

8.1.7 Primary surveillance radar (PSR) and secondary surveillance radar (SSR or MSSR) may be used either alone or in combination in the provision of air traffic services, including in the provision of separation between aircraft, provided:

- a) reliable coverage exists in the area; and b) the probability of detection, the accuracy and the integrity of the radar system(s) are satisfactory.

8.1.8 PSR systems should be used in circumstances where SSR alone would not meet the air traffic services requirements.

8.1.9 SSR systems, especially those with monopulse technique or Mode S capability, may be used alone, including in the provision of separation between aircraft, provided: a) the carriage of SSR transponders is mandatory within the area; and b) aircraft identification is established and maintained by use of assigned discrete SSR codes. *Note.— Monopulse technique is a radar technique in which azimuth information of an SSR*

transponder aircraft is derivable from each pulse detection by comparison of signals received simultaneously in two or more antenna beams. Monopulse SSR sensors provide for an improved azimuth resolution, fewer false reports from unsynchronized interrogator transmissions (fruit) and less garbling compared to conventional SSR sensors.

8.1.10 The use of radar in air traffic services must be limited to specified areas of radar coverage and must be subject to such other limitations as have been specified by the appropriate ATS authority. Adequate information on the operating methods used must be published in aeronautical information publications, as well as operating practices and/or equipment limitations having direct effects on the operation of the air traffic services. *Note.— States will provide information on the area or areas where PSR and SSR are in use as well as radar services and procedures in accordance with Annex 15, 4.1.1 and Appendix 1.*

8.1.11 Where PSR and SSR are required to be used in combination, SSR alone may be used in the event of PSR failure to provide separation between identified transponder equipped aircraft, provided the accuracy of the SSR position indications has been verified by monitor equipment or other means.

8.2 SURVEILLANCE SYSTEM : ADS B SYSTEMS CAPABILITIES

8.2.1 ADS B systems used in the provision of air traffic services must have a very high level of reliability, availability and integrity. The possibility of system failures or significant system degradations which may cause complete or partial interruptions of service must be very remote. Back-up facilities must be provided.

Note 1.— A ADS B system will normally consist of a number of integrated elements, including ADS B receiver(s), ADS B data transmission lines, ADS B data processing system, ADS B displays.

Note 2.— Guidance material and information pertaining to use of ADS B and to system reliability and availability is contained in Annex 10, Volume I and the Air Traffic Services Planning Manual (Doc 9426).

8.2.2 Multi- ADS B systems, i.e. systems utilizing more than one ADS B receiver, should have the capability to receive, process and display, in an integrated manner, data from all the connected receivers.

8.2.3 ADS B systems should be capable of integration with other automated systems used in the provision of ATS.

8.2.4 ADS B systems should provide for the display of safety-related alerts and warnings, including conflict alert, minimum safe altitude warning and conflict prediction.

8.2.5 States should, to the extent possible, facilitate the sharing of ADS B information in order to extend and improve ADS B coverage in adjacent control areas.

8.2.6 States should, on the basis of regional air navigation agreements, provide for the automated exchange of coordination data relevant to aircraft being provided with ADS B services, and establish automated coordination procedures.

8.2.7 ADS B may be used either alone or cooperatively with other services in the provision of air traffic services, including in the provision of separation between aircraft, provided the probability of detection, the accuracy and the integrity of the ADS B system(s) are satisfactory.

8.2.8 ADS-B systems may be used alone, including in the provision of separation between aircraft, provided:

- a) the carriage of ADS-B is mandatory within the area; and
- b) aircraft identification is established and maintained.

8.2.9 The use of ADS B in air traffic services must be limited to specified areas of ADS B coverage and must be subject to such other limitations as have been specified by the appropriate ATS authority. Adequate information on the operating methods used must be published in aeronautical information publications, as well

as operating practices and/or equipment limitations having direct effects on the operation of the air traffic services.

Note: - States shall provide information on the area or areas where ADS B services and procedures in accordance with Annex 15, 4.1.1, and Appendix 1.

Comment: Annex 15 Appendix 1 ENR 1.6 should be re-worded "surveillance Services" and a new para ENR 1.6.3 ADS.B..

8.3 PRESENTATION OF RADAR INFORMATION

8.3.1 Radar-derived information available for display to the Air Traffic Controller must, as a minimum, include radar position indications, radar map information and, when available, information from SSR Mode A, Mode C and Mode S.

8.3.2 The radar system must provide for a continuously updated presentation of radar-derived information, including radar position indications.

8.3.3 Radar position indications may be displayed as:

- a) radar position symbols (RPS), including:
 - i) PSR symbols;
 - ii) SSR symbols; and
 - iii) combined PSR/SSR symbols;
- b) PSR blips; c) SSR responses.

8.3.4 When applicable, distinct symbols should be used for presentation of:

- a) unintentionally duplicated SSR codes;
- b) predicted positions for a non-updated track; and
- c) plot and track data.

8.3.5 Reserved SSR codes, including 7500, 7600 and 7700, operation of IDENT, safety-related alerts and warnings as well as information related to automated coordination must be presented in a clear and distinct manner, providing for ease of recognition.

8.3.6 Radar labels should be used to provide, in alphanumeric form, SSR-derived as well as other information which may be available.

8.3.7 Radar label information must as a minimum include the SSR code transmitted by an aircraft or, when code/call sign conversion is effected, aircraft identification, and SSR Mode C-derived level information. All label information must be presented in a clear and concise manner.

8.3.8 Radar labels must be associated with their radar position indications in a manner precluding erroneous identification by or confusion on the part of the Air Traffic Controller.

8.4 PRESENTATION OF ADS B INFORMATION

8.4.1 ADS B information available for display to the Air Traffic Controller must, as a minimum, include ADS B position indications, altitude, aircraft identification and map information.

8.4.2 The ADS B system must provide for a continuously updated presentation of ADS B -derived information, including ADS B position indications.

8.4.3 ADS B position indications may be displayed as ADS B position symbols (ADS B PS), ~~including:~~

8.4.4 When appropriate, distinct symbols should be used for presentation of:

- a) predicted positions for a non-updated track; and
- b) plot and track data.

8.4.5 Reserved SSR codes, including 7500, 7600 and 7700 and their ADS-B message set equivalents, operation of IDENT, safety-related alerts and warnings as well as information related to automated coordination shall be presented in a clear and distinct manner providing for ease of recognition.

8.4.6 ADS B labels should be used to provide, in alphanumeric form, other information which may be available.

8.4.7 ADS B label information must as a minimum include ~~the unique 24-bit address or identification transmitted by the aircraft, and level information. ADS-B position and identification transmitted by an aircraft.~~ All label information must be presented in a clear and concise manner.

~~8.4.8 ADS B labels must be associated with their ADS B position indications in a manner precluding erroneous identification by or confusion on the part of the Air Traffic Controller.~~

8.5 COMMUNICATIONS

8.5.1 The level of reliability and availability of communications systems must be such that the possibility of system failures or significant degradations is very remote. Adequate backup facilities must be provided.

Note.— Guidance material and information pertaining to system reliability and availability are contained in Annex 10, Volume I and the Air Traffic Services Planning Manual (Doc 9426).

8.5.2 Direct pilot-controller communications must be established prior to the provision of Surveillance services, unless special circumstances such as emergencies dictate otherwise.

8.6 PROVISION OF RADAR SERVICES

8.6.1 Where suitable radar systems and communication systems are available, radar-derived information, including safety-related alerts and warnings such as conflict alert and minimum safe altitude warning, should be used to the extent possible in the provision of air traffic control service in order to improve capacity and efficiency as well as to enhance safety.

8.6.2 The number of aircraft simultaneously provided with radar services must not exceed that which can safely be handled under the prevailing circumstances, taking into account:

- a) the structural complexity of the control area or sector concerned;
- b) the radar functions to be performed within the control area or sector concerned;
- c) assessments of Air Traffic Controller workloads and sector capacity;
- d) the degree of technical reliability and availability of the main radar and communication systems;
- e) the possibility of a radar equipment failure or other emergency that would eventually require reverting to back-up facilities and/or non-radar separation; and
- f) the degree of technical reliability and availability of the back-up radar and communication systems.

8.7 PROVISION OF ADS B SERVICES

8.7.1 Where suitable ADS B systems and communication systems are available, ADS B-derived information, including safety-related alerts and warnings such as conflict alert and minimum safe altitude warning, should be

used to the extent possible in the provision of air traffic control service in order to improve capacity and efficiency as well as to enhance safety.

8.7.2 The number of aircraft simultaneously provided with ADS B services must not exceed that which can safely be handled under the prevailing circumstances, taking into account:

- a) the structural complexity of the control area or sector concerned;
- b) the ADS B functions to be performed within the control area or sector concerned;
- c) assessments of Air Traffic Controller workloads and sector capacity;
- d) the degree of technical reliability and availability of the main ADS B and communication systems;
- e) the possibility of a ADS B equipment failure or other emergency that would eventually require reverting to back-up facilities and/or non-ADS B separation; and
- f) the degree of technical reliability and availability of the back-up ADS B and communication systems

8.8 FUNCTIONS OF SURVEILLANCE SYSTEM DERIVED DATA

8.8.1 The information presented on an air situational display should be used to perform the following functions in the provision of air traffic services:

- a. to provide surveillance services as necessary to improve airspace utilisation, reduce delays, provide for direct routings and more optimum flight profiles, and enhance safety;
- b. to provide vectoring to:
 - i) departing aircraft to facilitate an expeditious and efficient departure flow and expediting climb to cruising level;
 - ii) aircraft to resolve potential conflicts;
 - iii) arriving aircraft to establish an expeditious and efficient approach sequence;
 - iv) assist pilots in their navigation;
- c. to provide separation and maintain normal traffic flow when an aircraft experiences communication failure within surveillance coverage;
- e. to maintain surveillance monitoring of air traffic; and/or
- f. to maintain a watch on the progress of air traffic in order to provide a non-surveillance Air Traffic Controller with:
 - i. improved position information regarding aircraft under control;
 - ii. supplementary information regarding other traffic; and
 - iii. information regarding any significant deviations, by aircraft from the terms of their respective clearances

Note: The absence of a functioning specific Surveillance system site monitor must preclude use of the specific surveillance system for separation by the Air Traffic Controller. The event must be recorded in the station log.

8.9 USE OF SSR TRANSPONDERS

8.9.1 To ensure the safe and efficient use of SSR, pilots and Air Traffic Controllers must strictly adhere to published operating procedures. Standard radiotelephony phraseology must be used and the correct setting of transponder codes must be ensured at all times.

8.9.2 SSR Code management

8.9.2.1 Codes 7700, 7600 and 7500 must be reserved internationally for use by pilots encountering a state of emergency, radio communication failure or unlawful interference, respectively.

8.9.2.2 SSR Codes are to be allocated and assigned in accordance with the following principles.

8.9.2.2.1 Codes should be allocated to States or areas in accordance with regional air navigation agreements, taking into account overlapping radar coverage over adjacent airspaces.

8.9.2.2.2 The appropriate ATS authority must establish a plan and procedures for the allocation of codes to ATS units.

8.9.2.2.3 The plan and procedures should be compatible with those practised in adjacent States.

8.9.2.2.4 The allocation of a code should preclude the use of this code for any other function within the area of coverage of the same SSR for a prescribed time period.

8.9.2.2.5 To reduce pilot and Air Traffic Controller workload and the need for Air Traffic Controller/pilot communications, the number of code changes required of the pilot should be kept to the minimum.

8.9.2.2.6 Codes must be assigned to aircraft in accordance with the plan and procedures laid down by the appropriate ATS authority.

8.9.2.2.7 Where there is a need for individual aircraft identification, each aircraft must be assigned a discrete code which should, whenever possible, be retained throughout the flight.

8.9.2.3 SSR Codes must be reserved, as necessary, for exclusive use by medical aircraft operating in areas of international armed conflict. SSR Codes must be allocated by ICAO through its Regional Offices in coordination with States concerned and should be assigned to aircraft for use within the area of conflict. *Note.* — The term “medical aircraft” refers to aircraft protected under the Geneva Conventions of 1949 and under the Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the protection of victims of international armed conflicts (Protocol I).

8.9.3 Operation of SSR transponders *Note.*— SSR transponder operating procedures are contained in Procedures for Air Navigation Services — Aircraft Operations (PANS-OPS, Doc 8168), Volume I, Part VIII.

8.9.3.1 When, after a pilot has been directed to operate the aircraft’s transponder on an assigned code, or to effect a code change, it is observed that the code shown on the radar display is different from that assigned to the aircraft, the pilot must be requested to reselect the assigned code.

8.9.3.2 Whenever it is observed that the code of an aircraft as shown on the radar display, or aircraft identification where code/call sign conversion is effected, is different from that assigned to the aircraft and the application of the procedure described in

8.9.3.3 has not resolved this discrepancy or is not warranted by circumstances (e.g. unlawful interference), the pilot must be requested to confirm the correct code has been selected.

8.9.3.4 If the discrepancy still persists, the pilot may be requested to stop the operation of the aircraft's transponder. The next control position and any other affected unit using SSR in the provision of ATS must be informed accordingly.

8.9.3.5 Aircraft equipped with Mode S having an aircraft identification feature must transmit the aircraft identification as specified in Item 7 of the ICAO flight plan or, when no flight plan has been filed, the aircraft registration. *Note. — All Mode S-equipped aircraft engaged in international civil aviation are required to have an aircraft identification feature (Annex 10, Volume IV, Chapter 2, 2.1.5.2 refers).*

8.9.3.6 Whenever it is observed on the radar display that the aircraft identification transmitted by a Mode S-equipped aircraft is different from that expected from the aircraft, the pilot must be requested to reselect aircraft identification.

8.9.3.7 If, following confirmation by the pilot that the correct aircraft identification has been set on the Mode S identification feature, the discrepancy continues to exist, the following actions must be taken by the Air Traffic Controller:

- a) inform the pilot of the persistent discrepancy;
- b) where possible, rectify the radar label showing the aircraft identification on the radar display; and c) notify the erroneous identification transmitted by the aircraft to the next control position and any other interested unit using Mode S for identification purposes.

8.9.4 Level information based on the use of Mode C

8.9.4.1 VERIFICATION OF ACCURACY OF MODE C-DERIVED LEVEL INFORMATION

8.9.4.1.1 The tolerance value used to determine that Mode C-derived level information displayed to the Air Traffic Controller is accurate must be ± 90 m (± 300 ft).

8.9.4.1.2 Verification of the accuracy of Mode C-derived level information displayed to the Air Traffic Controller must be effected at least once by each suitably equipped ATC unit on initial contact with the aircraft concerned or, if this is not feasible, as soon as possible thereafter. The verification must be effected by simultaneous comparison with altimeter derived level information received from the same aircraft by radiotelephony. The pilot of the aircraft whose Mode C-derived level information is within the approved tolerance value need not be advised of such verification.

8.9.4.1.3 If the displayed level information is not within the approved tolerance value or when a discrepancy in excess of the approved tolerance value is detected subsequent to verification, the pilot must be advised accordingly and requested to check the pressure setting and confirm the aircraft's level.

8.9.4.1.4 If, following confirmation of the correct pressure setting the discrepancy continues to exist, the following action should be taken according to circumstances:

- a) request the pilot to stop Mode C transmission, provided this does not interrupt the operation of the transponder on Mode A and notify the next control positions or ATC unit concerned with the aircraft of the action taken; or
- b) inform the pilot of the discrepancy and request that Mode C operation continue in order to prevent loss of position and identity information on the aircraft and notify the next control position or ATC unit concerned with the aircraft of the action taken.

8.9.4.2 DETERMINATION OF LEVEL OCCUPANCY SSR Mode C

8.9.4.2.1 The criterion which must be used to determine that a specific level is occupied by an aircraft must be ± 90 m (± 300 ft), except that appropriate ATS authorities may specify a smaller criterion but not less than

+/-60 m (+/-200 ft) if this is found to be more practical. *Note.— For a brief explanation of the considerations underlying this value see the Air Traffic Services Planning Manual (Doc 9426).*

8.9.4.2.2 *Aircraft maintaining a level.* An aircraft is considered to be maintaining its assigned level as long as the SSR Mode C-derived level information indicates that it is within ± 90 m (± 300 ft) of the assigned level.

8.9.4.2.3 *Aircraft vacating a level.* An aircraft cleared to leave a level is considered to have commenced its manoeuvre and vacated the previously occupied level when the SSR Mode C-derived level information indicates a change of more than 90 m (300 ft) in the anticipated direction from its previously assigned level.

8.9.4.2.4 *Aircraft passing a level in climb or descent.* An aircraft in climb or descent is considered to have crossed a level when the SSR Mode C-derived level information indicates that it has passed this level in the required direction by more than 90 m (300 ft).

8.9.4.2.5 *Aircraft reaching a level.* An aircraft is considered to have reached the level to which it has been cleared when three consecutive renewals of Mode C-derived level information have indicated that it is within 90 m (300 ft) of its assigned level.

Note.— In automated ATS systems, the cycles of renewals of Mode C data may not be evident to Air Traffic Controllers. It may, therefore, be necessary to specify in instructions to Air Traffic Controllers the number of display repetition cycles, or a time interval, corresponding to three consecutive renewals of Mode C data.

8.9.4.2.6 Intervention by a Air Traffic Controller must only be required if differences in level information between that displayed to the Air Traffic Controller and that used for control purposes are in excess of the values stated above.

8.10 USE OF ADS B TRANSCEIVERS

8.10.1 To ensure the safe and efficient use of ADS B Transceivers pilots and Air Traffic Controllers must strictly adhere to published operating procedures. Standard radiotelephony phraseology must be used and the correct setting of aircraft identification transponder codes must be ensured at all times.

8.10.2 Aircraft equipped with ADSB having an aircraft identification feature must transmit the aircraft identification as required.

8.10.3 When, after a pilot has been directed to operate the aircraft's transponder on an assigned callsign, or to effect a callsign change, it is observed that the callsign shown on the controller's display is different from that assigned to the aircraft, the pilot shall be requested to reselect the assigned callsign.

8.10.4 Whenever it is observed that the callsign of an aircraft as shown on the controller's display, is different from that assigned to the aircraft and the application of the procedure described in 8.10.3 has not resolved this discrepancy or is not warranted by circumstances (e.g. unlawful interference), the pilot shall be requested to confirm the correct callsign has been selected.

8.10.5 If the discrepancy still persists, the pilot may be requested to stop the operation of the aircraft's transponder. The next control position and any other affected unit using ADS-B in the provision of ATS shall be informed accordingly.

8.10.6 If, following confirmation by the pilot that the correct aircraft identification has been set on the ADS B identification feature, and the discrepancy continues to exist, the following actions must be taken by the Air Traffic Controller:

- a) inform the pilot of the persistent discrepancy;
- b) where possible, rectify the radar label showing the aircraft identification on the radar display; and

c) notify the erroneous identification transmitted by the aircraft to the next control position and any other interested unit using ADS B for identification purposes.

Note: In the ADS-B system, the pilot enters the Flight Identity into the control panel. The ADS-B transponder spontaneously transmits the Flight Identity. Provided Flight Identity is allocated uniquely, there can be no ambiguity. Also all Mode S ADS-B messages inherently contain the aircraft's unique 24-bit address. ATC automation systems can check for consistency between the Flight Identity and the airframe registration recorded in the Flight Plan.

8.10.4 Level information based on the use of ADS B

8.10.4.1 VERIFICATION OF ACCURACY OF ADS B -DERIVED LEVEL INFORMATION

8.10.4.1.1 The tolerance value used to determine that ADS B-derived level information displayed to the Air Traffic Controller is accurate must be ± 60 m (± 200 ft) in RVSM airspace. In other airspace, it shall be ± 90 m (± 300 ft), except that the appropriate ATS authority may specify a smaller criterion, but not less than 60 m (± 200 ft), if this is found to be more practical. ADS B Geometric Height information must not be used for separation.

8.10.4.1.2 Verification of the accuracy of ADS B-derived level information displayed to the Air Traffic Controller must be effected at least once by each suitably equipped ATC unit on initial contact with the aircraft concerned or, if this is not feasible, as soon as possible thereafter. The verification must be effected by simultaneous comparison with altimeter derived level information received from the same aircraft by radiotelephony. The pilot of the aircraft whose ADS B-derived level information is within the approved tolerance value need not be advised of such verification. Unverified ADS B Geometric Height information must not be used to determine if altitude differences exist.

8.10.4.1.3 If the displayed level information is not within the approved tolerance value or when a discrepancy in excess of the approved tolerance value is detected subsequent to verification, the pilot must be advised accordingly and requested to check the pressure setting and confirm the aircraft's level.

8.10.4.1.4 If, following confirmation of the correct pressure setting the discrepancy continues to exist, the following action should be taken according to circumstances:

a) request the pilot to stop transmission of ADS-B derived altitude information provided this does not cause the loss of position or identity information on the aircraft, and notify the next control position or ATC unit concerned with the aircraft of the action taken.

b) inform the pilot of the discrepancy and request that ADS B operation continue in order to prevent loss of position and identity information on the aircraft and notify the next control position or ATC unit concerned with the aircraft of the action taken.

8.10.4.2 DETERMINATION OF LEVEL OCCUPANCY ADS B

8.10.4.2.1 The criterion which must be used to determine that a specific level is occupied by an aircraft must be ± 90 m (± 300 ft), except that appropriate ATS authorities may specify a smaller criterion but not less than ± 60 m (± 200 ft) if this is found to be more practical.

Note.— For a brief explanation of the considerations underlying this value see the Air Traffic Services Planning Manual (Doc 9426).

8.10.4.2.2 *Aircraft maintaining a level.* An aircraft is considered to be maintaining its assigned level as long as the ADS B-derived level information indicates that it is within ± 90 m (± 300 ft) of the assigned level.

8.10.4.2.3 *Aircraft vacating a level.* An aircraft cleared to leave a level is considered to have commenced its manoeuvre and vacated the previously occupied level when the ADS B-derived level information indicates a change of more than 90 m (300 ft) in the anticipated direction from its previously assigned level.

8.10.4.2.4 *Aircraft passing a level in climb or descent.* An aircraft in climb or descent is considered to have crossed a level when the ADS B-derived level information indicates that it has passed this level in the required direction by more than 90 m (300 ft).

8.10.4.2.5 *Aircraft reaching a level.* An aircraft is considered to have reached the level to which it has been cleared when three consecutive renewals of ADS B-derived level information have indicated that it is within 90 m (300 ft) of its assigned level.

Note.— In automated ATS systems, the cycles of renewals of ADS B data may not be evident to Air Traffic Controllers. ADS B update cycles can be 1 per second.

8.10.4.2.6 Intervention by a Air Traffic Controller must only be required if differences in level information between that displayed to the Air Traffic Controller and that used for control purposes are in excess of the values stated above.

8.11 GENERAL SURVEILLANCE SYSTEMS PROCEDURES:

8.11.1 Performance checks

8.11.1.1 The Air Traffic Controller must adjust the Surveillance system display(s) and carry out adequate checks on the accuracy thereof, in accordance with the technical instructions prescribed by the appropriate authority for the Surveillance system equipment concerned.

8.11.1.2 The Air Traffic Controller must be satisfied that the available functional capabilities of the Surveillance system as well as the information presented on the Surveillance system display(s) is adequate for the functions to be performed.

8.11.1.3 The Air Traffic Controller must report, in accordance with local procedures, any fault in the equipment, or any incident requiring investigation, or any circumstances which make it difficult or impractical to provide Surveillance system services.

Note: The absence of a functioning, specific Surveillance system site monitor must preclude use of the specific surveillance system for separation by the Air Traffic Controller. The event must be recorded in the station log.

Note: ADS-B shall not be used for separation when a RAIM prediction notice indicates that RAIM may not be available.

8.11.2 General surveillance

8.10.2.1 Insofar as the performance of other functions permits, the Surveillance system Air Traffic Controller must:

- a. maintain general surveillance of the area of responsibility;
- b. advise the pilot of an identified aircraft when the aircraft concerned is observed to deviate significantly from a route or holding pattern authorised by its air traffic clearance, or is observed to make an incorrect position report; and
- c. initiate incident reporting procedures in respect of any aircraft which is believed to be operating within controlled or restricted airspace without authorisation.

8.10.2.2 Deviations from tracks and holding patterns are not considered significant until the appropriate procedural navigation tolerance is exceeded, or unless an aircraft is observed to be at a position and on a heading which in the Air Traffic Controller's opinion would result in the aircraft deviating from such airspace.

8.11.3 Identification of aircraft

8.11.3.1 ESTABLISHMENT OF SPECIFIC SURVEILLANCE SYSTEM IDENTIFICATION

8.11.3.2 Before providing a Surveillance system service to an aircraft, identification must be established. Thereafter, identification must be maintained until termination of the Surveillance system service.

8.11.3.1.2 If a specific Surveillance system identification is subsequently lost, the pilot must be informed accordingly and, when applicable, appropriate instructions issued.

8.11.3.1.3 A Surveillance system identification must be established by at least one of the following methods.

8.11.3.2 SSR IDENTIFICATION PROCEDURES

8.11.3.2.1 Where SSR is used, aircraft may be identified by one or more of the following procedures:

a) recognition of the aircraft identification in a radar label;

Note.— The use of this procedure requires that the code/call sign correlation is achieved successfully, taking into account the Note following b) below.

b) recognition of an assigned discrete code, the setting of which has been verified, in a radar label; *Note.— The use of this procedure requires a system of code assignment which ensures that each aircraft in a given portion of airspace is assigned a discrete code*

c) direct recognition of the aircraft identification of a Mode S-equipped aircraft in a radar label;

Note.— The aircraft identification feature available in Mode S transponders provides the means to identify directly individual aircraft on radar displays and thus offers the potential to eliminate ultimately the recourse to Mode A discrete codes for individual identification. This elimination will only be achieved in a progressive manner depending on the state of deployment of suitable ground and airborne installations.

d) by transfer of radar identification (see 8.8.3);

e) observation of compliance with an instruction to set a specific code;

f) observation of compliance with an instruction to squawk IDENT;

Note 1.— In automated radar systems, the “IDENT” feature may be presented in different ways, e.g. as a flashing of all or part of the radar position and associated data block.

Note 2.— Garbling of transponder replies may produce “IDENT”-type of indications. Nearly simultaneous “IDENT” transmissions within the same area may give rise to errors in identification.

8.11.3.2.2 When a discrete code has been assigned to an aircraft, a check must be made at the earliest opportunity to ensure that the code set by the pilot is identical to that assigned for the flight. Only after this check has been made must the discrete code be used as a basis for identification.

8.11.4 PSR IDENTIFICATION PROCEDURES 8.11.4.1 Where SSR is not used or available, radar identification must be established by at least one of the following methods:

a) by correlating a particular radar position indication with an aircraft reporting its position over, or as bearing and distance from, a point displayed on the radar map, and by ascertaining that the track of the particular radar position is consistent with the aircraft path or reported heading;

Note 1.— Caution must be exercised when employing this method since a position reported in relation to a point may not coincide precisely with the radar position indication of the aircraft on the radar map. The appropriate ATS authority may, therefore, prescribe additional conditions for the application of this method, e.g.: i) a level or levels above which this method may not be applied in respect of specified

navigation aids; or ii) a distance from the radar site beyond which this method may not be applied. Note 2.— The term “a point” refers to a geographical point suitable for the purposes of radar identification. It is normally a reporting point defined by reference to a radio navigation aid or aids.

b) by correlating an observed radar position indication with an aircraft which is known to have just departed, provided that the identification is established within 2 km (1 NM) from the end of the runway used. Particular care should be taken to avoid confusion with aircraft holding over or overflying the aerodrome, or with aircraft departing from or making a missed approach over adjacent runways;

c) by transfer of radar identification

d) by ascertaining the aircraft heading, if circumstances require, and following a period of track observation: — instructing the pilot to execute one or more changes of heading of 30 degrees or more and correlating the movements of one particular radar position indication with the aircraft’s acknowledged execution of the instructions given; or — correlating the movements of a particular radar position indication with manoeuvres currently executed by an aircraft having so reported. When using these methods, the radar Air Traffic Controller must: i) verify that the movements of not more than one radar position indication correspond with those of the aircraft; and ii) ensure that the manoeuvre(s) will not carry the aircraft outside the coverage of the radar display.

Note 1.— Caution must be exercised when employing these methods in areas where route changes normally take place. Note 2.— With reference to ii) above, see also 8.9.5.1 regarding radar vectoring of controlled aircraft.

8.11.4.2 Use may be made of direction-finding bearings to assist in radar identification of an aircraft. This method, however, must not be used as the sole means of establishing radar identification, unless so prescribed by the appropriate ATS authority for particular cases under specified conditions.

8.11.4.3 When two or more radar position indications are observed in close proximity, or are observed to be making similar movements at the same time, or when doubt exists as to the identity of a radar position indication for any other reason, changes of heading should be prescribed or repeated as many times as necessary, or additional methods of identification should be employed, until all risk of error in identification is eliminated.

8.11.2.3 ADS B IDENTIFICATION PROCEDURES

8.11.2.3.1 ADS B identification must be established by at least one of the following methods:

- a) direct recognition of the aircraft identification in an ADS-B label;
- b) by correlating a particular ADS B position indication with an aircraft reporting its position over, or as bearing and distance from, a point displayed on the ATC Air Situation Display, and by ascertaining that the track of the particular displayed position is consistent with the aircraft path or reported heading;

Note 1.— The term “a point” refers to a geographical point suitable for the purposes of ADS B identification. It is normally a reporting point defined by reference to a radio navigation aid or aids.

c) by correlating an observed ADS B position indication with an aircraft which is known to have just departed, provided that the identification is established within 2 km (1 NM) from the end of the runway used. Particular care should be taken to avoid confusion with aircraft holding over or overflying the aerodrome, or with aircraft departing from or making a missed approach over adjacent runways;

d) by transfer of ADS B identification (see 8.9.3);

e) observation of compliance with an instruction to squawk ident

Comment: The use of identification technique a) may not be required

8.11.2.3.3 When two or more ADS B position indications are observed in close proximity, or are observed to be making similar movements at the same time, or when doubt exists as to the identity of a ADS B position indication for any other reason, changes of heading should be prescribed or repeated as many times as necessary, or additional methods of identification should be employed, until all risk of error in identification is eliminated.

Comment: The ADS B discrete 24 bit aircraft code provides distinct identification capacity and the use of turns for ident are not seen as being required

8.11.3 Transfer of radar identification

8.11.3.1 Transfer of radar identification from one radar Air Traffic Controller to another should only be attempted when it is considered that the aircraft is within the accepting Air Traffic Controller's radar coverage.

8.11.3.2 Transfer of radar identification must be effected by one of the following methods:

a) designation of the radar position indication by automated means, provided that only one radar position indication is thereby indicated and there is no possible doubt of correct identification;

b) notification of the discrete code of the aircraft;

Note.— The use of this procedure requires a system of code assignment which ensures that each aircraft in a given portion of airspace is assigned a discrete code (see 8.9.2.2.7).

c) notification that the aircraft is Mode S-equipped with an aircraft identification feature when Mode S coverage is available;

d) direct designation (pointing with the finger) of the radar position indication, if the two radar displays are adjacent, or if a common "conference" type of radar display is used;

Note.— Attention must be given to any errors which might occur due to parallax effects.

e) designation of the radar position indication by reference to, or in terms of bearing and distance from, a geographical position or navigational facility accurately indicated on both radar displays, together with the track of the observed radar position indication if the route of the aircraft is not known to both Air Traffic Controllers;

Note.— Caution must be exercised before establishing radar identification using this method, particularly if other radar position indications are observed on similar headings and in close proximity to the aircraft under radar control. Inherent radar deficiencies, such as inaccuracies in bearing and distance of the radar position indications displayed on individual radars and parallax errors, may cause the indicated position of an aircraft in relation to the known point to differ between the two radar displays. The appropriate ATS authority may, therefore, prescribe additional conditions for the application of this method, e.g.: i) a maximum distance from the common reference point used by the two Air Traffic Controllers; and ii) a maximum distance between the radar position indication as observed by the accepting Air Traffic Controller and the one stated by the transferring Air Traffic Controller.

f) instruction to the aircraft by the transferring Air Traffic Controller to change code and the observation of the change by the accepting Air Traffic Controller; or

g) instruction to the aircraft by the transferring Air Traffic Controller to squawk IDENT and observation of this response by the accepting Air Traffic Controller;

Note.— Use of procedures f) and g) requires prior coordination between the Air Traffic Controllers, since the indications to be observed by the accepting Air Traffic Controller are of short duration.

8.11.4 Transfer of ADS B identification

8.11.4.1 Transfer of ADS B identification from one Air Traffic Controller to another should only be attempted when it is considered that the aircraft is within the accepting Air Traffic Controller's ADS B coverage.

8.11.4.2 Transfer of ADS B identification must be effected by one of the following methods:

- a) designation of the ADS B position indication by automated means, provided that only one ADS B position indication is thereby indicated and there is no possible doubt of correct identification;
- b) direct designation (pointing with the finger) of the ADS B position indication, if the two Air Situation Displays are adjacent, or if a common "conference" type of Air Situation Display is used;

Note.— Attention must be given to any errors which might occur due to parallax effects.

e) designation of the ADS B position indication by reference to, or in terms of bearing and distance from, a geographical position or navigational facility accurately indicated on both Air Situation displays, together with the track of the observed ADS B position indication if the route of the aircraft is not known to both Air Traffic Controllers;

Note.— Caution must be exercised before establishing ADS B identification using this method, particularly if other ADS B position indications are observed on similar headings and in close proximity to the aircraft under control. Inherent ADS B deficiencies may cause the indicated position of an aircraft in relation to the known point to differ between the two radar displays. The appropriate ATS authority may, therefore, prescribe additional conditions for the application of this method, e.g.: i) a maximum distance from the common reference point used by the two Air Traffic Controllers; and ii) a maximum distance between the radar position indication as observed by the accepting Air Traffic Controller and the one stated by the transferring Air Traffic Controller.

8.11.5 Position information

8.11.5.1 An aircraft provided with Surveillance system service should be informed of its position in the following circumstances:

- a) upon identification, except when the identification is established:
 - i) based on the pilot's report of the aircraft position or within one nautical mile of the runway upon departure and the observation is consistent with the aircraft's time of departure; or
 - ii) by use of assigned discrete SSR codes or Mode S and the location of the observed radar position indication is consistent with the current flight plan of the aircraft; or
 - iii) by transfer of radar identification;
 - iv) by transfer of ADS B position
- b) when the pilot requests this information;
- c) when a pilot's estimate differs significantly from the radar Air Traffic Controller's estimate based on radar observation;
- d) when a pilot's estimate differs significantly from the Air Traffic Controller's estimate based on observation;

d) when the pilot is instructed to resume own navigation after surveillance system vectoring if the current instructions had diverted the aircraft from a previously assigned route,;

e) immediately before termination of Surveillance system service, if the aircraft is observed to deviate from its intended route.

8.11.5.2 Position information must be passed to aircraft in one of the following forms:

- a) as a well-known geographical position;
- b) magnetic track and distance to a significant point, an en-route navigation aid, or an approach aid;
- c) direction (using points of the compass) and distance from a known position;
- d) distance to touchdown, if the aircraft is on final approach; or
- e) distance and direction from the centre line of an ATS route.

8.11.5.3 Whenever practicable, position information must relate to positions or routes pertinent to the navigation of the aircraft concerned and displayed on the Air Situation Display.

8.11.5.4 When so informed, the pilot may omit position reports at compulsory reporting points or report only over those reporting points specified by the air traffic services unit concerned, including points at which air-reports are required for meteorological purposes. Pilots must resume position reporting when so instructed and when advised that the Surveillance system service is terminated or that surveillance identification is lost.

8.11.6 Surveillance system vectoring

8.11.6.1 Surveillance system vectoring must be achieved by issuing to the pilot specific headings which will enable the aircraft to maintain the desired track. When vectoring an aircraft, a Surveillance system Air Traffic Controller should comply with the following:

a) whenever practicable, the aircraft should be vectored along routes or tracks on which the pilot can monitor the aircraft position with reference to pilot-interpreted navigation aids (this will minimize the amount of Surveillance system navigational assistance required and alleviate the consequences resulting from a radar failure);

b) when an aircraft is given a vector diverting it from a previously assigned route, the pilot should be informed, unless it is self-evident, what the vector is to accomplish and, when possible, the limit of the vector should be specified (e.g. to ... position, for ... approach);

c) except when transfer of Surveillance system control is to be effected, aircraft must not be vectored closer than 4.6 km (2.5 NM), or, where a Surveillance system separation minimum greater than 9.3 km (5 NM) is prescribed, a distance equivalent to one half of the prescribed separation minimum, from the limit of the airspace for which the radar Air Traffic Controller is responsible, unless local arrangements have been made to ensure that separation will exist with radar-controlled aircraft operating in adjoining areas;

d) controlled flights should not be vectored into uncontrolled airspace except in the case of emergency or in order to circumnavigate severe weather **where it is displayed to the controller** (in which case the pilot should be so informed), or at the specific request of the pilot; and

e) when an aircraft has reported unreliable directional instruments, the pilot should be requested, prior to the issuance of manoeuvring instructions, to make all turns at an agreed rate and to carry out the instructions immediately upon receipt.

8.11.6.2 When vectoring an IFR flight, the Surveillance system Air Traffic Controller must issue clearances such that the prescribed obstacle clearance will exist at all times until the aircraft reaches the point where

the pilot will resume own navigation. When necessary, the minimum Surveillance system vectoring altitude must include a correction for low temperature effect.

Note 1.— When an IFR flight is being vectored, the pilot is often unable to determine the aircraft's exact position and consequently the altitude which provides the required obstacle clearance. Detailed obstacle clearance criteria are contained in PANS-OPS (Doc 8168), Volume I, Part VI, Chapter 3 (Altimeter Corrections) and Volume II, Part II, Departure Procedures, Part III, 24.2.2.3 (Procedures based on tactical vectoring), and Part VI (Obstacle Clearance Criteria for Enroute). Note 2.— It is the responsibility of the ATS authority to provide the Air Traffic Controller with minimum altitudes corrected for temperature effect.

8.11.6.3 Whenever possible, minimum vectoring altitudes should be sufficiently high to minimize activation of aircraft ground proximity warning systems.

Note.— Activation of such systems will induce aircraft to pull up immediately and climb steeply to avoid hazardous terrain, possibly compromising separation between aircraft.

8.11.6.4 States must encourage operators to report incidents involving activations of aircraft ground proximity warning systems so that their locations can be identified and altitude, routing and/or aircraft operating procedures can be altered to prevent recurrences.

8.11.6.5 In terminating Surveillance system vectoring of an aircraft, the Surveillance system Air Traffic Controller must instruct the pilot to resume own navigation, giving the pilot the aircraft's position and appropriate instructions, as necessary, in the form prescribed in

8.11.7 Navigation assistance

8.11.7.1 An identified aircraft observed to deviate significantly from its intended route or designated holding pattern must be advised accordingly. Appropriate action must also be taken if, in the opinion of the Air Traffic Controller, such deviation is likely to affect the service being provided.

8.11.7.2 The pilot of an aircraft requesting navigation assistance from an air traffic control unit providing radar services must state the reason (e.g. to avoid areas of adverse weather or unreliable navigational instruments) and must give as much information as possible in the circumstances.

8.11.8 Interruption or termination of Surveillance system service

8.11.8.1 An aircraft which has been informed that it is provided with Surveillance system service should be informed immediately when, for any reason, Surveillance system service is interrupted or terminated.

8.11.8.2 When the control of an aircraft is to be transferred from a specific Surveillance system Air Traffic Controller to a non-Surveillance system Air Traffic Controller, the Surveillance system Air Traffic Controller must ensure that non-Surveillance system separation is established between that aircraft and any other controlled aircraft before the transfer is effected.

8.11.9 Minimum levels

8.11.9.1 A Surveillance system Air Traffic Controller must at all times be in possession of full and up-to-date information regarding:

a) established minimum flight altitudes within the area of responsibility;

b) the lowest usable flight level or levels determined in accordance with Chapters 4 and 5; and

c) established minimum altitudes applicable to procedures based on tactical Surveillance system vectoring.
Note.— Criteria for the determination of minimum altitudes applicable to procedures based on tactical Surveillance system vectoring are contained in Procedures for Air Navigation Services — Aircraft Operations (PANS-OPS, Doc 8168), Volume II, Part III.

8.11.10 Information regarding adverse weather

8. 11.10.1 Information that an aircraft appears likely to penetrate an area of adverse weather should be issued in sufficient time to permit the pilot to decide on an appropriate course of action, including that of requesting advice on how best to circumnavigate the adverse weather area, if so desired.

Note.— Depending on the capabilities of the radar system, areas of adverse weather may not be presented on the radar display. An aircraft's weather radar will normally provide better detection and definition of adverse weather than radar sensors in use by ATIS.

Comment: This needs review

8.11.10.2 In vectoring an aircraft for circumnavigating any area of adverse weather, the Surveillance system Air Traffic Controller should ascertain that the aircraft can be returned to its intended or assigned flight path within the available Surveillance system coverage, and, if this does not appear possible, inform the pilot of the circumstances.

Note.— Attention must be given to the fact that under certain circumstances the most active area of adverse weather may not show on a Surveillance system display.

8.11.11 Reporting of significant meteorological information to meteorological offices

Although a radar Air Traffic Controller is not required to keep a special watch for storm detection, etc., information on the position, intensity, extent and movement of significant weather (i.e. storms or well-defined frontal surfaces) as observed on Surveillance system displays, should, when practicable, be reported to the associated meteorological office.

8.12 USE of SURVEILLANCE SYSTEMS IN THE AIR TRAFFIC CONTROL SERVICE

Note.— The procedures in this Section are general procedures applicable when Surveillance Systems are used in the provision of area control service or approach control service. Additional procedures applicable in the provision of approach control service are detailed in Section 8.9.

Comment: Confirm not doubled up

8.12.1 Functions

The information presented on a Surveillance Systems display may be used to perform the following functions in the provision of air traffic control service:

- a) provide Surveillance Systems services as necessary in order to improve airspace utilization, reduce delays, provide for direct routings and more optimum flight profiles, as well as to enhance safety;
- b) provide Surveillance Systems vectoring to departing aircraft for the purpose of facilitating an expeditious and efficient departure flow and expediting climb to cruising level;
- c) provide Surveillance Systems vectoring to aircraft for the purpose of resolving potential conflicts;
- d) provide Surveillance Systems vectoring to arriving aircraft for the purpose of establishing an expeditious and efficient approach sequence;
- e) provide Surveillance Systems vectoring to assist pilots in their navigation, e.g. to or from a radio navigation aid, away from or around areas of adverse weather, etc.;
- f) provide separation and maintain normal traffic flow when an aircraft experiences communication failure within the area of the Surveillance Systems coverage;
- g) maintain Surveillance Systems monitoring of air traffic;

Note.— Where tolerances regarding such matters as adherence to track, speed or time have been prescribed by the appropriate ATS authority, deviations are not considered significant until such tolerances are exceeded.

h) when applicable, maintain a watch on the progress of air traffic, in order to provide a non-Surveillance Systems Air Traffic Controller with:

- i) improved position information regarding aircraft under control;
- ii) supplementary information regarding other traffic; and
- iii) information regarding any significant deviations by aircraft from the terms of their respective air traffic control clearances, including their cleared routes as well as levels, when appropriate.

8.12.2 Coordination of traffic under Surveillance Systems and non-Surveillance Systems control

Appropriate arrangements must be made in any air traffic control unit using Surveillance Systems to ensure the coordination of traffic under Surveillance Systems control with traffic under non-Surveillance Systems control, and to ensure the provision of adequate separation between the Surveillance Systems-controlled aircraft and all other controlled aircraft. To this end, close liaison must be maintained at all times between Surveillance Systems Air Traffic Controllers and non-Surveillance Systems Air Traffic Controllers.

8.12.3 Separation application

Comment: See response in WP/26 8.7.3

Note.— Factors which the Surveillance Systems Air Traffic Controller must take into account in determining the spacing to be applied in particular circumstances in order to ensure that the separation minimum is not infringed include aircraft relative headings and speeds, Surveillance Systems technical limitations, Air Traffic Controller workload and any difficulties caused by communication congestion. Guidance material on this subject is contained in the Air Traffic Services Planning Manual (Doc 9426).

8.12.3.1 Except as provided for, Surveillance Systems separation must only be applied between identified aircraft when there is reasonable assurance that identification will be maintained.

8.12.3.2 Except when transfer of Surveillance Systems control is to be effected, non-Surveillance Systems separation must be established by a Surveillance Systems Air Traffic Controller before an aircraft under Surveillance Systems control reaches the limits of the Air Traffic Controller's area of responsibility, or before the aircraft leaves the area of Surveillance Systems coverage.

8.12.3.3 When authorized by the appropriate ATS authority, Surveillance Systems separation based on the use of RPS and/or PSR blips must be applied so that the distance between the centres of the RPS's and/or PSR blips, representing the positions of the aircraft concerned, is never less than a prescribed minimum.

8.12.3.4 Surveillance Systems separation based on the use of PSR blips and SSR or ADS B responses must be applied so that the distance between the centre of the PSR blip and the nearest edge of the SSR or ADS B response (or the centre, when authorized by the appropriate ATS authority) is never less than a prescribed minimum.

8.12.3.5 Surveillance Systems separation based on the use of SSR or ADS B responses must be applied so that the distance between the closest edges of the SSR or ADS B responses (or the centres, when authorized by the appropriate authority) is never less than a prescribed minimum.

8.12.3.6 In no circumstances must the edges of the Surveillance Systems position indications touch or overlap unless vertical separation is applied between the aircraft concerned, irrespective of the type of Surveillance Systems position indication displayed and Surveillance Systems separation minimum applied.

8.12.3.7 In the event that the Surveillance Systems Air Traffic Controller has been notified of a controlled flight entering or about to enter the airspace within which Surveillance Systems separation is applied, but

has not Surveillance Systems identified the aircraft, the Air Traffic Controller may, if so prescribed by the appropriate ATS authority, continue to provide Surveillance Systems service to identified aircraft provided that:

a) reasonable assurance exists that the unidentified controlled flight will be identified using SSR, ADS B or the flight is being operated by an aircraft of a type which may be expected to give an adequate return on primary Surveillance Systems in the airspace within which Surveillance Systems separation is applied; and

b) Surveillance Systems separation is maintained between the Surveillance Systems controlled flights and any other observed Surveillance Systems position until either the unidentified controlled flight has been identified or non-Surveillance Systems separation has been established.

8.12.3.8 Surveillance Systems separation may be applied between an aircraft taking off and a preceding departing aircraft or other Surveillance Systems-controlled traffic provided there is reasonable assurance that the departing aircraft will be identified within 2 km (1 NM) from the end of the runway, and that, at the time, the required separation will exist.

8.12.3.9 Surveillance Systems separation must not be applied between aircraft holding over the same holding point. Application of Surveillance Systems separation between holding aircraft and other flights must be subject to requirements and procedures prescribed by the appropriate ATS authority.

8.12.4 Surveillance Systems separation minima

Comment: See WP/26 8.7.4 should be split into radar/ADSb

8.12.4.1 Unless otherwise prescribed in accordance with 8.10.4.2, 8.10.4.3 or 8.12.4.4, or Chapter 6 with respect to independent and dependent parallel approaches, the horizontal Surveillance Systems separation minimum must be 9.3 km (5.0 NM).

8.12.4.2 The Surveillance Systems separation minimum in 8.10.4.1 may, if so prescribed by the appropriate ATS authority, be reduced, but not below:

a) 5.6 km (3.0 NM) when Surveillance Systems capabilities at a given location so permit; and

b) 4.6 km (2.5 NM) between succeeding aircraft which are established on the same final approach track within 18.5 km (10 NM) of the runway end. A reduced separation minimum of 4.6 km (2.5 NM) may be applied, provided:

i) the average runway occupancy time of landing aircraft is proven, by means such as data collection and statistical analysis and methods based on a theoretical model, not to exceed 50 seconds;

ii) braking action is reported as good and runway occupancy times are not adversely affected by runway contaminants such as slush, snow or ice;

iii) a Surveillance Systems system with appropriate azimuth and range resolution and an update rate of 5 seconds or less is used in combination with suitable Surveillance Systems displays; and

iv) the aerodrome Air Traffic Controller is able to observe, visually or by means of surface movement radar (SMR) or a surface movement guidance and control system (SMCGS), the runway-in-use and associated exit and entry taxiways;

v) wake turbulence Surveillance Systems separation minima in 8.10.4.4, or as may be prescribed by the appropriate ATS authority (e.g. for specific aircraft types), do not apply;

vi) aircraft approach speeds are closely monitored by the Air Traffic Controller and when necessary adjusted so as to ensure that separation is not reduced below the minimum;

vii) aircraft operators and pilots have been made fully aware of the need to exit the runway in an expeditious manner whenever the reduced separation minimum on final approach is applied; and viii) procedures concerning the application of the reduced minimum are published in AIPs.

8.12.4.3 The Surveillance Systems separation minimum or minima to be applied must be prescribed by the appropriate ATS authority according to the capability of the particular Surveillance Systems system or sensor to accurately identify the aircraft position in relation to the centre of an RPS, PSR ADSBPS blip or SSR response and taking into account factors which may affect the accuracy of the Surveillance Systems-derived information, such as aircraft range from the surveillance system site.

8.12.4.4 The following wake turbulence Surveillance Systems separation minima must be applied to aircraft in the approach and departure phases of flight in the circumstances given in 8.10.4.4.1.

| <i>Aircraft category</i> | | |
|---------------------------|----------------------------|---|
| <i>Preceding aircraft</i> | <i>Succeeding aircraft</i> | <i>Wake turbulence Surveillance Systems separation minima</i> |
| HEAVY | HEAVY MEDIUM LIGHT | 7.4 km (4.0 NM) 9.3 km (5.0 NM) 11.1 km (6.0 NM) |
| MEDIUM | LIGHT | 9.3 km (5.0 NM) |

Note.— The provisions governing wake turbulence aircraft categorization are set forth in Chapter 4, Section 4.9.

8.12.4.4.1 The minima set out in 8.9.4.4 must be applied when:

- a) an aircraft is operating directly behind another aircraft at the same altitude or less than 300 m (1 000 ft) below; or
- b) both aircraft are using the same runway, or parallel runways separated by less than 760 m; or c) an aircraft is crossing behind another aircraft, at the same altitude or less than 300 m (1 000 ft) below.

Note.— See Figures 8-1A and 8-1B.

8.12.5 Transfer of Surveillance Systems control

8.12.5.1 Transfer of Surveillance Systems control should be effected whenever practicable so as to enable the uninterrupted provision of surveillance Systems services.

8.12.5.2 Where SSR or ADS-B is used and the Surveillance Systems ground system provides for the display of radar/ADS-B Surveillance Systems position indications with associated Surveillance Systems labels, transfer of Surveillance Systems control of aircraft between adjacent control positions or between adjacent ATC units may be effected without prior coordination, provided that:

- a) updated flight plan information on the aircraft about to be transferred, including the discrete assigned SSR Code, is provided to the accepting Air Traffic Controller prior to transfer;
- b) surveillance Systems coverage provided to the accepting Air Traffic Controller is such that the aircraft concerned is presented on the Surveillance Systems display before the transfer is effected and is identified on, but preferably before, receipt of the initial call;

c) when the Air Traffic Controllers are not physically adjacent, two way direct speech facilities, which permit communications to be established instantaneously, are available between them at all times;

Note.— “Instantaneous” refers to communications which effectively provide for immediate access between Air Traffic Controllers.

d) the transfer point or points and all other conditions of application, such as direction of flight, specified levels, transfer of communication points, and especially an agreed minimum separation between aircraft, including that applicable to succeeding aircraft on the same route, about to be transferred as observed on the display, have been made the subject of specific instructions (for intra-unit transfer) or of a specific letter of agreement between two adjacent ATC units;

e) the instructions or letter of agreement specify explicitly that the application of this type of transfer of ~~Surveillance Systems~~ control may be terminated at any time by the accepting Air Traffic Controller, normally with an agreed advance notice;

f) the accepting Air Traffic Controller is kept currently informed of any level, speed or vectoring instructions given to the aircraft prior to its transfer and which modify its anticipated flight progress at the point of transfer.

8.12.5.3 The minimum agreed separation between aircraft about to be transferred (8.12.5.2 d) refers) and the advance notice (8.12.5.2 e) refers) must be determined taking into account all relevant technical, operational and other circumstances. If circumstances arise in which these agreed conditions can no longer be satisfied, Air Traffic Controllers must revert to the procedure in 8.12.5.4 until the situation is resolved.

8.12.5.4 Where primary radar is being used, and where SSR is employed but the provisions of 8.12.5.2 are not applied, the transfer of ~~radar~~ control of aircraft between adjacent control positions or between two adjacent ATS units may be effected, provided that:

a) ~~Surveillance Systems~~ identification has been transferred to or has been established directly by the accepting ~~Surveillance Systems Air Traffic~~ Controller;

b) when the ~~Surveillance Systems Air Traffic~~ Controllers are not physically adjacent, two-way direct-speech facilities between them are at all times available which permit communications to be established instantaneously;

c) ~~Surveillance Systems~~ separation from other ~~Surveillance Systems~~ radar or ADS-B-controlled flights conforms to the minima authorized for use during transfer of ~~Surveillance Systems~~ control between the ~~Surveillance Systems~~ radar or ADS-B sectors or units concerned;

d) the accepting ~~Surveillance Systems Air Traffic~~ Controller is informed of any level, speed or vectoring instructions applicable to the aircraft at the point of transfer;

e) radio communication with the aircraft is retained by the transferring ~~Surveillance Systems Air Traffic~~ Controller until the accepting ~~Surveillance Systems Air Traffic~~ Controller has agreed to assume responsibility for providing surveillance ~~Systems~~ services to the aircraft. Thereafter, the aircraft should be instructed to change over to the appropriate frequency and from that point is the responsibility of the accepting ~~Surveillance Systems Air Traffic~~ Controller.

8.12.6 Speed control

Subject to conditions specified by the appropriate ATS authority, including consideration of aircraft performance limitations, a Surveillance Systems Air Traffic Controller may, in order to facilitate Surveillance Systems control or to reduce the need for Surveillance Systems vectoring, request aircraft under Surveillance Systems control to adjust their speed in a specified manner.

Note.— Procedures for speed control instructions are contained in Chapter 4, Section 4.6.

8.13 EMERGENCIES, HAZARDS AND EQUIPMENT FAILURES

Note.— See also Chapter 15.

Comment: Chap 15 **15.1.1.1**
Note 1 & 2
15.1.1.3
15.1.3.2 & Note
15.2 Note 2
15.3.1.1 (f)
15.3.1.6
15.3.1.7
15.6.2
15.6.4

8.13.1 Emergencies

8.13.1.1 In the event of an aircraft in, or appearing to be in, any form of emergency, every assistance must be provided by the Surveillance Systems Air Traffic Controller, and the procedures prescribed herein may be varied according to the situation.

8.13.1.2 The progress of an aircraft in emergency must be monitored and (whenever possible) plotted on the Surveillance Systems display until the aircraft passes out of Surveillance Systems coverage, and position information must be provided to all air traffic services units which may be able to give assistance to the aircraft. Surveillance Systems transfer to adjacent Surveillance Systems sectors must also be effected when appropriate.

Note.— If the pilot of an aircraft encountering a state of emergency has previously been directed by ATC to operate the transponder on a specific code, that code will normally be maintained unless, in special circumstances, the pilot has decided or has been advised otherwise. Where ATC has not requested a code to be set, the pilot will set the transponder to Mode A Code 7700.

8.13.2 Collision hazard information

8.13.2.1 When an identified controlled flight is observed to be on a conflicting path with an unknown aircraft deemed to constitute a collision hazard, the pilot of the controlled flight must, whenever practicable:

a) be informed of the unknown aircraft and if so requested by the controlled flight or, if in the opinion of the Surveillance Systems Air Traffic Controller the situation warrants, a course of avoiding action should be suggested; and

b) be notified when the conflict no longer exists.

8.13.2.2 When an identified IFR flight operating outside controlled airspace is observed to be on a conflicting path with another aircraft, the pilot should:

a) be informed as to the need for collision avoidance action to be initiated, and if so requested by the pilot or if, in the opinion of the Surveillance Systems Air Traffic Controller, the situation warrants, a course of avoiding action should be suggested; and

b) be notified when the conflict no longer exists.

8.13.2.3 Information regarding traffic on a conflicting path should be given, whenever practicable, in the following form:

a) relative bearing of the conflicting traffic in terms of the 12-hour clock;

b) distance from the conflicting traffic in kilometres (nautical miles);

c) direction in which the conflicting traffic appears to be proceeding;

d) level and type of aircraft or, if unknown, relative speed of the conflicting traffic, e.g. slow or fast.

8.13.2.4 SSR and ADS B-derived level information, even when unverified, should be used in the provision of collision hazard information because such information, particularly if available from an otherwise unknown aircraft (e.g. a VFR flight) and given to the pilot of a known aircraft, could facilitate the location of a collision hazard.

8.13.2.4.1 When the SSR and ADS B-derived level information has been verified, the information must be passed to pilots in a clear and unambiguous manner. If the level information has not been verified, the accuracy of the information should be considered uncertain and the pilot must be informed accordingly.

8.13.3 Failure of equipment

8.13.3.1 AIRCRAFT RADIO TRANSMITTER FAILURE

8.13.3.1.1 If two-way communication is lost with an aircraft, the Surveillance Systems Air Traffic Controller should determine whether or not the aircraft's receiver is functioning by instructing the aircraft on the frequency so far used to acknowledge by making a specified manoeuvre and by observing the aircraft's track, or by instructing the aircraft to operate IDENT or to make code changes.

Note.— Transponder-equipped aircraft experiencing radio-communication failure will operate the transponder on Mode A Code 7600.

8.13.3.1.2 If the action prescribed in 8.13.3.1.1 is unsuccessful, it must be repeated on any other available frequency on which it is believed that the aircraft might be listening.

8.13.3.1.3 In both the cases covered by 8.13.3.1.1 and 8.13.3.1.2, any manoeuvring instructions must be such that the aircraft would regain its current cleared track after having complied with the instructions received.

8.13.3.1.4 Where it has been established by the action in 8.13.3.1.1 that the aircraft's radio receiver is functioning, continued control of transponder-equipped aircraft where SSR is available can be effected using code changes or IDENT transmissions to obtain acknowledgement of clearances issued to the aircraft.

8.13.3.2 COMPLETE AIRCRAFT COMMUNICATION FAILURE

When a controlled aircraft experiencing complete communication failure is operating or expected to operate in an area and at flight levels where Surveillance Systems separation is applied, such separation may continue to be used. However, if the aircraft experiencing the communication failure is not identified, Surveillance Systems separation must be applied between aircraft under Surveillance Systems control and all unidentified aircraft observed along the expected route of the aircraft with the communication failure, until such time as it is known, or can safely be assumed, that the aircraft with radio failure has passed through the airspace concerned, has landed, or has proceeded elsewhere.

8.13.3.3 AIRCRAFT TRANSPONDER FAILURE IN AREAS WHERE THE CARRIAGE OF A FUNCTIONING TRANSPONDER IS MANDATORY

8.13.3.3.1 When an aircraft experiencing transponder failure after departure is operating or expected to operate in an area where the carriage of a functioning transponder with specified capabilities is mandatory, the ATC units concerned should endeavour to provide for continuation of the flight to the aerodrome of first intended landing in accordance with the flight plan. However, in certain traffic situations, either in terminal areas or en-route, continuation of the flight may not be possible, particularly when failure is detected shortly after take-off. The aircraft may then be required to return to the departure aerodrome or to land at the nearest suitable aerodrome acceptable to the operator concerned and to ATC.

8.13.3.3.2 In case of a transponder failure which is detected before departure from an aerodrome where it is not practicable to effect a repair, the aircraft concerned should be permitted to proceed, as directly as possible, to the nearest suitable aerodrome where repair can be made. When granting clearance to such aircraft, ATC should take into consideration the existing or anticipated traffic situation and may have to modify the time of departure, flight level or route of the intended flight. Subsequent adjustments may become necessary during the course of the flight.

8.13.4 Surveillance Systems equipment failure

8.13.4.1 In the event of complete failure of the Surveillance Systems equipment except for air-ground communications, the Surveillance Systems Air Traffic Controller must:

- a) plot the positions of all aircraft already identified and, in conjunction with the non-Surveillance Systems Air Traffic Controller when applicable, take the necessary action to establish non-surveillance system separation between the aircraft; and when relevant:
- b) request the appropriate non-Surveillance Systems Air Traffic Controller to assume control of the traffic affected;
- c) instruct aircraft to communicate with the appropriate non-Surveillance Systems Air Traffic Controller for further instructions.

8.13.4.2 As an emergency measure, use of flight levels spaced by half the applicable vertical separation minimum may be resorted to temporarily if standard non-Surveillance Systems separation cannot be provided immediately.

8.13.4.3 Except when there is assurance that the complete Surveillance Systems equipment failure will be of a very limited duration, steps should be taken to limit the number of aircraft permitted to enter the area to that which can be safely handled without the use of Surveillance Systems.

8.13.5 Ground radio failure

8.13.5.1 In the event of complete failure of the ground radio equipment used for the Surveillance Systems control, the Surveillance Systems Air Traffic Controller must, unless able to continue to provide the Surveillance Systems service by means of other available communication channels, proceed as set forth in 8.11.4.1 a) and b).

8.11.5.2 Where the provisions in 8.11.4.1 are not applicable, the Air Traffic Controller must:

- a) without delay inform all adjacent control positions or ATC units, as applicable, of the failure;
- b) appraise such positions or units of the current traffic situation;
- c) request their assistance, in respect of aircraft which may establish communications with those positions or units, in establishing Surveillance Systems or non-Surveillance Systems separation between and maintaining control of such aircraft; and
- d) instruct adjacent control positions or ATC units to hold or reroute all controlled flights outside the area of responsibility of the position or ATC unit that has experienced the failure until such time that the provision of normal services can be resumed.

8.11.5.3 In order to reduce the impact of complete ground radio equipment failure on the safety of air traffic, the appropriate ATS authority should establish contingency procedures to be followed by control positions and ATC units in the event of such failures. Where feasible and practicable, such contingency procedures should provide for the delegation of control to an adjacent control position or ATC unit in order to permit a minimum level of services to be provided as soon as possible, following the ground radio failure and until normal operations can be resumed.

8.14 USE OF SURVEILLANCE SYSTEMS IN THE APPROACH CONTROL SERVICE

8.14.1 General provisions

~~8.14.1.1 Surveillance Systems used in the provision of approach control service must be appropriate to the functions and level of service to be provided.~~

~~8.14.1.2 Surveillance Systems used to monitor parallel ILS approaches must meet the requirements for such operations specified in Chapter 6.~~

8.14.2 Functions

~~The information presented on a Surveillance Systems display may be used to perform the following additional functions in the provision of approach control service:~~

- ~~a) provide Surveillance Systems vectoring of arriving traffic on to pilot interpreted final approach aids;~~
- ~~b) provide Surveillance Systems monitoring of parallel ILS approaches and instruct aircraft to take appropriate action in the event of possible or actual penetrations of the no transgression zone (NTZ);~~

~~Note. — See Chapter 6, Section 6.7.~~

- ~~c) provide Surveillance Systems vectoring of arriving traffic to a point from which a visual approach can be completed;~~
- ~~d) provide Surveillance Systems vectoring of arriving traffic to a point from which a precision Surveillance Systems approach or a surveillance Systems approach can be made;~~
- ~~e) provide Surveillance Systems monitoring of other pilot interpreted approaches;~~
- ~~f) in accordance with prescribed procedures, conduct:~~
 - ~~i) Surveillance Systems approaches;~~
 - ~~ii) precision radar (PAR) approaches; and~~
- ~~g) provide Surveillance Systems separation between:~~
 - ~~i) succeeding departing aircraft;~~
 - ~~ii) succeeding arriving aircraft; and~~
 - ~~iii) a departing aircraft and a succeeding arriving aircraft.~~

8.14.3 General approach Surveillance Systems procedures

~~8.14.3.1 The appropriate ATS authority must establish procedures to ensure that the aerodrome Air Traffic Controller is kept informed of the sequence of arriving aircraft, as well as any instructions and restrictions which have been issued to such aircraft in order to maintain separation after transfer of control to the aerodrome Air Traffic Controller.~~

~~8.14.3.2 Prior to, or upon commencement of, Surveillance Systems vectoring for approach, the pilot must be advised of the type of approach as well as the runway to be used.~~

~~8.14.3.3 The Surveillance Systems Air Traffic Controller must advise an aircraft being Surveillance Systems vectored for an instrument approach of its position at least once prior to commencement of final approach.~~

~~8.14.3.4 When giving distance information, the Surveillance Systems Air Traffic Controller must specify the point or navigation aid to which the information refers.~~

~~8.14.3.5 The initial and intermediate approach phases of an approach executed under the direction of a Surveillance Systems Air Traffic Controller comprise those parts of the approach from the time Surveillance Systems vectoring is initiated for the purpose of positioning the aircraft for a final approach, until the aircraft is on final approach and:~~

- ~~a) established on the final approach path of a pilot interpreted aid; or~~
- ~~b) reports that it is able to complete a visual approach; or~~

e) ready to commence a surveillance radar approach; or

d) transferred to the precision radar approach Air Traffic Controller.

8.14.3.6 Aircraft vectored for final approach should be given a heading or a series of headings calculated to close with the final approach track. The final vector must enable the aircraft to be established in level flight on the final approach track prior to intercepting the specified or nominal glide path if an MLS, ILS or radar approach is to be made, and should provide an intercept angle with the final approach track of 45 degrees or less.

Note.— See Chapter 6, Section 6.7.3.2, concerning Surveillance Systems vectoring of independent parallel approaches.

8.14.3.7 Whenever an aircraft is assigned a Surveillance Systems vector which will take it through the final approach track, it should be advised accordingly, stating the reason for the vector.

8.14.4 Vectoring to pilot interpreted final approach aid

8.14.4.1 An aircraft vectored to intercept a pilot interpreted final approach aid must be instructed to report when established on the final approach track. Clearance for the approach should be issued prior to when the aircraft reports established, unless circumstances preclude the issuance of the clearance at such time. Surveillance Systems vectoring will normally terminate at the time the aircraft leaves the last assigned heading to intercept the final approach track.

8.14.4.2 The Surveillance Systems Air Traffic Controller must be responsible for maintaining Surveillance Systems separation between succeeding aircraft on the same final approach, except that the responsibility may be transferred to the aerodrome Air Traffic Controller in accordance with procedures prescribed by the appropriate ATS authority and provided Surveillance Systems information is available to the aerodrome Air Traffic Controller.

8.14.4.3 Transfer of control of succeeding aircraft on final approach from the Surveillance Systems Air Traffic Controller to the aerodrome Air Traffic Controller must be effected in accordance with procedures prescribed by the appropriate ATS authority.

8.14.4.4 Transfer of communications to the aerodrome Air Traffic Controller should be effected at such a point or time that clearance to land or alternative instructions can be issued to the aircraft in a timely manner.

8.14.5 Vectoring for visual approach

Note.— See also Chapter 6, Section 6.5.3.

8.14.5.1 The Surveillance Systems Air Traffic Controller may initiate Surveillance Systems vectoring of an aircraft for visual approach provided the reported ceiling is above the minimum altitude applicable to Surveillance Systems vectoring and meteorological conditions are such that, with reasonable assurance, a visual approach and landing can be completed.

8.14.5.2 Clearance for visual approach must be issued only after the pilot has reported the aerodrome or the preceding aircraft in sight, at which time Surveillance Systems vectoring would normally be terminated.

8.14.6 Surveillance System approaches

8.14.6.1 GENERAL PROVISIONS

~~8.14.6.1.1 During the period that a Surveillance Systems Air Traffic Controller is engaged in giving surveillance system or precision radar approaches, the Air traffic Controller should not be responsible for any duties other than those directly connected with such approaches.~~

~~8.14.6.1.2 Surveillance Systems Air Traffic Controllers conducting Surveillance Systems approaches must be in possession of information regarding the obstacle clearance altitudes/heights established for the types of approach to be conducted.~~

~~8.14.6.1.3 Prior to commencement of a Surveillance system approach, the aircraft must be informed of:~~

- ~~a) the runway to be used;~~
- ~~b) the applicable obstacle clearance altitude/height;~~
- ~~c) the angle of the nominal glide path and, if so prescribed by the appropriate ATS authority or requested by the aircraft, the approximate rate of descent to be maintained;~~

~~Note. — See the Air Traffic Services Planning Manual (Doc 9426) regarding calculation of approximate rates of descent.~~

~~d) the procedure to be followed in the event of radio communication failure, unless the procedure has been published in AIPs.~~

~~8.14.6.1.4 When a Surveillance System approach cannot be continued due to any circumstance, the aircraft should be immediately informed that a Surveillance System approach or continuation thereof is not possible. The approach should be continued if this is possible using non radar facilities or if the pilot reports that the approach can be completed visually; otherwise an alternative clearance should be given.~~

~~8.14.6.1.5 Aircraft making a Surveillance System approach should be reminded, when on final approach, to check that the wheels are down and locked.~~

~~8.14.6.1.6 Unless otherwise prescribed by the appropriate ATS authority, the radar Air Traffic Controller should notify the aerodrome Air Traffic Controller or, when applicable, the non-Surveillance System Air Traffic Controller when an aircraft making a Surveillance System approach is approximately 15 km (8 NM) from touchdown. If landing clearance is not received at this time, a subsequent notification should be made at approximately 8 km (4 NM) from touchdown and landing clearance requested.~~

~~8.14.6.1.7 Clearance to land or any alternative clearance received from the aerodrome Air Traffic Controller or, when applicable, the non-Surveillance System Air Traffic Controller should normally be passed to the aircraft before it reaches a distance of 4 km (2 NM) from touchdown.~~

~~8.14.6.1.8 An aircraft making a Surveillance System approach should:~~

- ~~a) be directed to execute a missed approach in the following circumstances:~~
 - ~~i) when the aircraft appears to be dangerously positioned on final approach; or~~
 - ~~ii) for reasons involving traffic conflicts; or~~
 - ~~iii) if no clearance to land has been received from the non-Surveillance System Air Traffic Controller by the time the aircraft reaches a distance of 4 km (2 NM) from touchdown or such other distance as has been agreed with the aerodrome control tower; or iv) on instructions by the aerodrome Air Traffic Controller; or~~
- ~~b) be advised to consider executing a missed approach in the following circumstances:~~
 - ~~i) when the aircraft reaches a position from which it appears that a successful approach cannot be completed; or~~
 - ~~ii) if the aircraft is not visible on the Surveillance System display for any significant interval during the last 4 km (2 NM) of the approach; or~~
 - ~~iii) if the position or identification of the aircraft is in doubt during any portion of the final approach. In all such cases, the reason for the instruction or the advice should be given to the pilot.~~

~~8.14.6.1.9 Unless otherwise required by exceptional circumstances, Surveillance system instructions concerning a missed approach should be in accordance with the prescribed missed approach procedure and should include the level to which the aircraft is to climb and heading instructions to keep the aircraft within the missed approach area during the missed approach procedure.~~

8.14.7 Final approach procedures

8.14.7.1 SURVEILLANCE RADAR APPROACH

~~8.14.7.1.1 A final approach using solely surveillance radar should not be carried out if precision approach radar is available, unless meteorological conditions are such as to indicate with reasonable certainty that a surveillance radar approach can be completed successfully.~~

~~8.14.7.1.2 A surveillance radar approach must only be performed with equipment suitably sited and a radar display specifically marked to provide information on position relative to the extended centre line of the runway to be used and distance from touchdown, and which is specifically approved for the purpose by the appropriate ATS authority.~~

~~8.14.7.1.3 When conducting a surveillance radar approach, the radar Air Traffic Controller must comply with the following:~~

- ~~a) at or before the commencement of the final approach, the aircraft must be informed of the point at which the surveillance radar approach will be terminated;~~
- ~~b) the aircraft must be informed when it is approaching the point at which it is computed that descent should begin, and just before reaching that point it must be informed of the obstacle clearance altitude/height and instructed to descend and check the applicable minima;~~
- ~~c) azimuth instructions must be given in accordance with the precision approach technique (see 8.11.7.2.4);~~
- ~~d) except as provided in 8.11.7.1.4, distance from touchdown must normally be passed at every 2 km (each NM);~~
- ~~e) pre-computed levels through which the aircraft should be passing to maintain the glide path must also be transmitted at every 2 km (each NM) at the same time as the distance;~~
- ~~f) the surveillance radar approach must be terminated:~~
 - ~~i) at a distance of 4 km (2 NM) from touchdown, except as provided in 8.12.7.1.4; or~~
 - ~~ii) before the aircraft enters an area of continuous radar clutter; or~~
 - ~~iii) when the pilot reports that a visual approach can be effected; whichever is the earliest.~~

~~8.14.7.1.4 When, as determined by the appropriate ATS authority, the accuracy of the radar equipment permits, surveillance radar approaches may be continued to the threshold of the runway, or to a prescribed point less than 4 km (2 NM) from touchdown, in which case:~~

- ~~a) distance and level information must be given at each km (each half NM);~~
- ~~b) transmission should not be interrupted for intervals of more than five seconds while the aircraft is within a distance of 8 km (4 NM) from touchdown;~~
- ~~c) the radar Air Traffic Controller should not be responsible for any duties other than those directly connected with a particular approach.~~

~~8.14.7.1.5 Levels through which the aircraft should pass to maintain the required glide path, and the associated distances from touchdown, must be pre-computed and displayed in such a manner as to be readily available to the radar Air Traffic Controller.~~

Note.— See the Air Traffic Services Planning Manual (Doc 9426) regarding pre-computation of levels.

8.14.7.2 PRECISION RADAR APPROACH

8.14.7.2.1 DUTIES OF PRECISION APPROACH AIR TRAFFIC CONTROLLER

~~During the period the radar Air Traffic Controller is engaged in giving a precision approach, the Air Traffic Controller should not be responsible for any duties other than those directly connected with that particular approach.~~

8.14.7.2.2 TRANSFER OF CONTROL

~~Aircraft to be provided with a precision radar approach must have been transferred to the radar Air Traffic Controller in charge of the precision approach at a distance of not less than 2 km (1 NM) from the point of interception of the glide path, unless otherwise provided by the appropriate ATS authority.~~

8.14.7.2.3 COMMUNICATIONS

~~When control of the aircraft is assumed by the Surveillance system Air Traffic Controller in charge of the precision approach, a communications check must be made on the channel to be used during the precision approach and the pilot must be advised that no further acknowledgement of transmission is required. Thereafter, transmission should not be interrupted for intervals of more than five seconds while the aircraft is on final approach.~~

8.14.7.2.4 AZIMUTH INFORMATION AND CORRECTIONS

~~8.14.7.2.4.1 The pilot must be informed at regular intervals of the aircraft's position in relation to the extended centre line of the runway. Heading corrections must be given as necessary to bring the aircraft back on to the extended centre line.~~

~~8.14.7.2.4.2 In the case of azimuth deviations, the pilot should not take corrective action unless specifically instructed to do so.~~

8.14.7.2.5 ELEVATION INFORMATION AND ADJUSTMENTS

~~8.14.7.2.5.1 The aircraft must be informed when it is approaching the point of interception of the glide path and, just before intercepting the glide path, it must be instructed to begin its descent and to check the applicable decision altitude/height. Thereafter, the aircraft must be informed at regular intervals of its position in relation to the glide path. When no corrections are required, the aircraft should be informed at regular intervals that it is on the glide path. Deviations from the glide path must be given to the aircraft, together with instructions to adjust the rate of descent if the corrective action taken by the aircraft does not appear to be sufficient. The aircraft must be informed when it starts to regain the glide path, and immediately before it reaches the glide path.~~

~~8.14.7.2.5.2 In the case of deviations from the glide path, the pilot should take corrective action on the basis of the information given by the Air Traffic Controller, even though not specifically instructed to do so.~~

~~8.14.7.2.5.3 Prior to the aircraft reaching a point 4 km (2 NM) from touchdown, or a greater distance as necessary for faster aircraft, a certain degree of tolerance should be allowed with regard to deviations from the glide path, and elevation information need not specify the actual number of metres (or feet) above or below the glide path unless it is required to emphasize the rate of change or the extent of the displacement. Thereafter, any deviations from the glide path should be given to the aircraft, preferably in terms of specific distances (metres or feet) above or below the glide path. The use of emphasis in the manner in which the information is transmitted should normally be sufficient to expedite action by the pilot when necessary (e.g. "STILL 20 metres (60 feet) too low").~~

~~8.14.7.2.5.4 Should the elevation element fail during a precision Surveillance system approach, the Surveillance system Air Traffic Controller must inform the aircraft immediately. If possible, the Air Traffic Controller must change to a surveillance Surveillance system approach, informing the aircraft of the revised obstacle clearance altitude/height. Alternatively, instructions should be given for a missed approach.~~

~~8.14.7.2.6 DISTANCE INFORMATION The distance from touchdown should be transmitted at intervals of 2 km (1 NM) until the aircraft reaches a distance of 8 km (4 NM) from touchdown. Thereafter distance information should be transmitted at more frequent intervals, priority being given, however, to the provision of azimuth and elevation information and guidance.~~

~~8.14.7.2.7 TERMINATION OF A PRECISION RADAR APPROACH~~

~~A precision radar approach is terminated when the aircraft reaches the point at which the glide path intercepts the obstacle clearance altitude/height. Nevertheless, information must continue to be given until the aircraft is over the threshold, or at such distance there from as may be specified by the appropriate ATS authority, taking into account the capability of the equipment concerned. The approach may be monitored to touchdown and information may continue to be provided as necessary at the discretion of the radar Air Traffic Controller in charge of the precision approach in which case the aircraft must be informed when it is over the threshold.~~

~~8.14.7.2.8 MISSED APPROACHES When information provided by the elevation element indicates that the aircraft may be initiating a missed approach, the radar Air Traffic Controller must take the following action: a) when there is sufficient time to obtain a reply from the pilot (e.g. when the aircraft is more than 4 km (2 NM) from touchdown), the radar Air Traffic Controller must transmit the aircraft's height above the glide path and ask if the pilot intends to make a missed approach. If this is confirmed by the pilot, the radar Air Traffic Controller must pass missed approach instructions (see 8.12.6.1.8); b) when there is not sufficient time to obtain a reply from the pilot (e.g. when the aircraft is at 4 km (2 NM) or less from touchdown) the precision approach should be continued, emphasizing the aircraft's displacement, and terminated at the normal termination point. If it is apparent from elevation information that the aircraft is making a missed approach, either before or after the normal termination point, the radar Air Traffic Controller must pass missed approach instructions (see 8.11.6.1.8).~~

8.15 USE OF SURVEILLANCE SYSTEMS IN THE AERODROME CONTROL SERVICE

8.15.1 Surveillance Systems

~~8.15.1.1 When authorized by and subject to conditions prescribed by the appropriate ATS authority, surveillance Systems may be used in the provision of aerodrome control service to perform the following functions:~~

- ~~a) Surveillance Systems monitoring of aircraft on final approach;~~
- ~~b) Surveillance Systems monitoring of other aircraft in the vicinity of the aerodrome;~~
- ~~c) establishing Surveillance Systems separation between succeeding departing aircraft; and~~
- ~~d) providing navigation assistance to VFR flights.~~

~~8.15.1.2 Special VFR flights must not be Surveillance Systems vectored unless special circumstances, such as emergencies, dictate otherwise.~~

~~8.15.1.3 Caution must be exercised when Surveillance Systems vectoring VFR flights so as to ensure that the aircraft concerned does not inadvertently enter instrument meteorological conditions.~~

~~8.15.1.4 In prescribing conditions and procedures for the use of Surveillance Systems in the provision of aerodrome control service, the appropriate ATS authority must ensure that the availability and use of Surveillance Systems information will not be detrimental to visual observation of aerodrome traffic.~~

Note. — Control of aerodrome traffic is in the main based on visual observation of the manoeuvring area and the vicinity of the aerodrome by the aerodrome Air Traffic Controller.

8.15.2 Use of surface movement radar (SMR)

Note. — Requirements concerning the provision of SMR are contained in Annex 14, Volume I, Chapter 8. Guidance material on the use of SMR is contained in the Air Traffic Services Planning Manual (Doc 9426), Part II.

8.15.2.1 GENERAL PROVISIONS

~~8.15.2.1.1 The use of SMR should be related to the operational conditions and requirements of the particular aerodrome (i.e. visibility conditions, traffic density and aerodrome layout).~~

~~8.15.2.1.2 SMR systems must to the extent possible enable the detection and display of the movement of all aircraft and vehicles on the manoeuvring area in a clear and unambiguous manner.~~

~~8.15.2.1.3 Aircraft and vehicle radar position indications may be displayed in symbolic or non-symbolic form. Where radar labels are available for display, the capability should be provided for inclusion of aircraft and vehicle identification by manual or automated means.~~

8.15.2.2 FUNCTIONS

~~8.15.2.2.1 SMR should be used to augment visual observation of traffic on the manoeuvring area and to provide surveillance of traffic on those parts of the manoeuvring area which cannot be observed visually.~~

~~8.15.2.2.2 The information displayed on an SMR display may be used to assist in:~~

- ~~a) monitoring of aircraft and vehicles on the manoeuvring area for compliance with clearances and instructions;~~
- ~~b) determining that a runway is clear of traffic prior to a landing or take-off;~~
- ~~c) providing information on essential local traffic on or near the manoeuvring area;~~
- ~~d) determining the location of aircraft and vehicles on the manoeuvring area;~~
- ~~e) providing directional taxi information to aircraft when requested by the pilot or deemed necessary by the Air Traffic Controller. Except under special circumstances, e.g. emergencies, such information should not be issued in the form of specific heading instructions; and f) providing assistance and advice to emergency vehicles.~~

8.15.2.3 IDENTIFICATION OF AIRCRAFT

~~Where SMR is used, aircraft may be identified by one or more of the following procedures:~~

- ~~a) by correlating a particular radar position indication with:
 - ~~i) an aircraft position visually observed by the Air Traffic Controller;~~
 - ~~ii) an aircraft position reported by the pilot; or~~
 - ~~iii) an identified radar position indication displayed on a surveillance radar display;~~~~
- ~~b) by transfer of radar identification when authorized by the appropriate ATS authority; and~~
- ~~e) by automated identification procedures when authorized by the appropriate ATS authority.~~

8.16 USE OF SURVEILLANCE SYSTEMS IN THE FLIGHT INFORMATION SERVICE

~~Note. The use of Surveillance Systems in the provision of flight information service does not relieve the pilot in command of an aircraft of any responsibilities, including the final decision regarding any suggested alteration of the flight plan.~~

8.16.1 Functions

~~8.16.1.1 The information presented on a Surveillance Systems display may be used to provide identified aircraft with:~~

- ~~a) information regarding any aircraft observed to be on a conflicting path with the Surveillance Systems-identified aircraft and suggestions or advice regarding avoiding action;~~
- ~~b) information on the position of significant weather and, as practicable, advice to the aircraft on how best to circumnavigate any such areas of adverse weather (see 8.6.9.2, Note); c) information to assist the aircraft in its navigation.~~

~~8.14.1.2 Surveillance Systems air traffic advisory service. When Surveillance Systems is used in the provision of air traffic advisory service, the procedures in Section 8.2 for the use of Surveillance Systems in the air traffic control service must be applied subject to the conditions and limitations governing the provision of air traffic advisory service, as set forth in Chapter 9, 9.1.4~~